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EDITED AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

APRIL 1995

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## HACKERS

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# technology review

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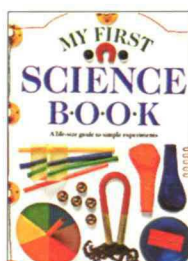
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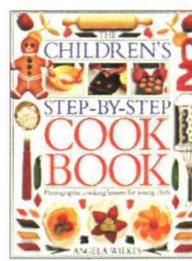


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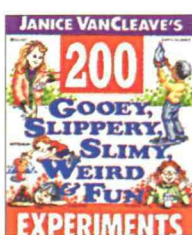


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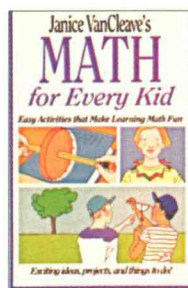


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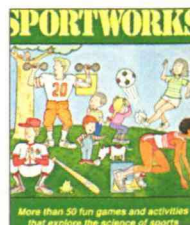


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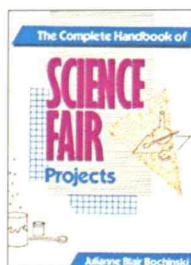


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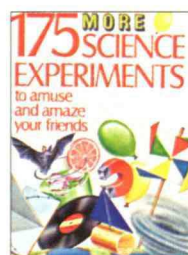


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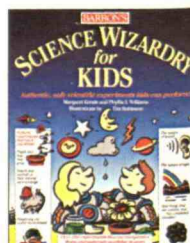


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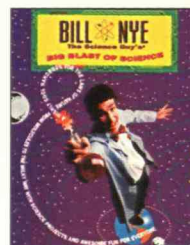


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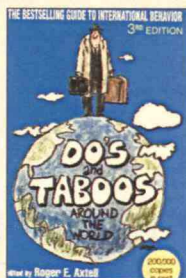
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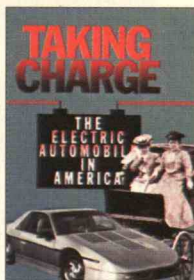
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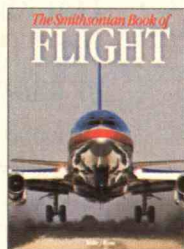
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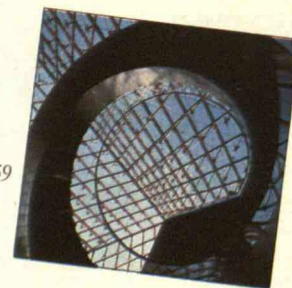
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# 1995

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# First Line

## So Credible, It's Incredible

**I**N his prime, boxer Muhammad Ali used to delight in boasting, "I am the greatest." Some people thought this was arrogant, certainly immodest. But since when is a public figure modest? And besides, there was some truth to his claim: the only fighter ever to achieve the world heavyweight championship three times, he was proud to observe he could "float like a butterfly, sting like a bee."

In a comparable spirit of achievement and pride, let me share some news about another "public figure," one that similarly aims to be both graceful and pointed—the very magazine you are now holding in your hands. In terms of credibility, *Technology Review* is also "the greatest"—we can legitimately claim to be the most credible media outlet in the United States—and in terms of objectivity and influence, it is almost the greatest.

I'm referring to the recently announced results of "Opinion Leaders 1994," a biennial "national study of contemporary issue involvement and media influence" conducted by Erdos & Morgan/MPG, a prominent New York-based opinion-research firm that describes itself as "the leading supplier to the publishing community for reader surveys."

The company sampled a universe of some 320,000 accomplished people from business, government, and academia who were asked to evaluate 64 of the country's leading magazines and newspapers and 31 television news programs. If they read or watched a publication or program at least occasionally, they essentially voted on whether it embodied each of five "qualitative measurements": *influential* on economic, social, cultural, or political issues; *objective* reporting; *current* on topical issues; *credible* source of information; and *enjoyable*.

It would have been a sufficient honor just to belong to this august group. Imagine: of all the thousands of media outlets in the United States, *Technology Review* was included—right up there

with the *New Yorker*, the *Washington Post*, and *NBC Nightly News*—in an elite listing of 95 (only two-thirds of which were print). But we also stood out in that company. *TR* ranked in the top 10 in two of the five categories.

As you may have already guessed, *Technology Review* was number one among the "most credible," ahead of the others in the top 10—*Scientific American*, the *Economist*, *National Geographic*, the *New England Journal of Medicine*, *Science*, the *MacNeil/Lehrer*

*It's good  
to be a contender,  
even better to win.*

*News Hour*, the *National Review*, *Smithsonian*, and *Harvard Business Review*—and all the rest.

Number six is also good among an elite 95, and that is where *Technology Review* ranked in "most objective," behind the *National Journal*, the *MacNeil/Lehrer News Hour*, the *New England Journal of Medicine*, *Science*, and *Scientific American*, but ahead of *Harvard Business Review*, the *Journal of the American Medical Association*, *Roll Call*, *National Geographic*, and 85 others.

People often have a winner-take-all mentality: if you're not number one, or not in the top 10, say, then you're off the screen. Thus at first we celebrated *TR*'s distinction in the "credible" and "objective" categories while studiously ignoring the other three. But it pays to look at the data: sometimes there are useful results to discover—or, as a newspaper-reporter friend commented in this case, to "spin doctor"—among the also-rans.

It turns out that we fared quite respectably in the other three categories as well. *Technology Review* was number 13—just slightly removed from the top 10—in "most influential," ranking only a smidgen behind *Science* and well ahead of, for example, *Scientific American*, *Business Week*, and the *New Republic*.

*TR* was 45 in "most enjoyable," cer-

tainly far from the top 10. But although science and technology policy are not usually associated with "enjoyment," we were still in the top half. And to this ex-roadrunner, often older and heavier than others in the race, to finish in the top half seems like a real accomplishment. In any case, look who finished behind us: the *New York Times*, *Fortune*, and the nightly half-hour news shows of the three major TV networks, plus 45 others.

Our seemingly poorest showing was among the "most current," where we ranked 66th—not even in the top half. But the majority of the entrants—virtually all the 31 TV programs, for example—were dailies or weeklies, which by definition are more current than a monthly. The real question is: How current was *Technology Review* compared with other monthly magazines? There we showed very well, nearly tied with *Scientific American* and ahead of the *Atlantic*, *Audubon*, *Harper's*, and *Smithsonian*, for example.

In his typically terse and understated way, our associate publisher, Peter Gelatly, summed up *Technology Review*'s performance in the Opinion Leaders 1994 survey like this: "We are far more influential than our size would lead anyone to believe."

And in the manner of a film director receiving an Oscar, I would like to acknowledge the MIT Alumni/ae Association for having the guts and imagination, and willingness to marshal its resources, to sponsor such an effective outreach. We at *TR* like to think that we partially fulfill MIT's mission to educate not only students and graduates but also the whole world on "technology and its implications" and thereby help make the world a little better. To both readers and patrons, we promise to try to consolidate our gains and go beyond them. In future surveys, for example, I hope to tell you we're top 10 across the board, or to at least provide even more impressive spin doctoring. After all, if you can't believe the editor of the country's most credible publication, who *can* you believe? ■

—STEVEN J. MARCUS



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# Letters

## SCIENCE AND THE PEOPLE

In "Updating the Social Contract for Science" (*TR November/December 1994*), David H. Guston and Kenneth Keniston ably summarize government-science relations over the past half-century. However, as a basis for negotiating a new contract, their analysis of science is oversimplified. The authors characterize university science as a closed and delicate social enterprise funded principally by government and necessary to technological progress and socioeconomic well-being. On this basis, they conclude that government and an informed public have a right to participate in setting broad scientific research priorities but dare not intrude more deeply into the actual conduct of science.

While some may point to Stalinist and Nazi distortions of science as examples of what can result from societal interference, it's important to remember that those experiences did not result from political or social involvement per se but from the interventions of totalitarian states. Under different circumstances, one can find numerous examples of lay public involvement that have been constructive. Laypeople sit on medical ethics review boards, and research collaborations between grassroots groups and university scientists are responsible for a growing number of epidemiological insights. Pharmaceutical companies display enormous interest in indigenous peoples' botanical acumen, while cutting-edge agricultural biotechnology relies extensively on the selective breeding achievements of Third World farmers.

In Sweden, laypeople are in the majority on the government's well-regarded Council for Planning and Coordination of Research; and Japan, Germany, and other European nations have pioneered processes for involving both workers and users in developing new technologies and consumer products. The Danish government appoints panels of everyday citizens to cross-examine a range of experts, deliberate among themselves, and then publish their own social assessments of

scientific consequences and of alternative science and technology policies. This process is now being emulated in other countries, including the United Kingdom.

Meanwhile, Dutch universities have created a network of 50 public "science shops" that screen questions from community groups and refer challenging problems to university volunteers, both students and faculty. This system has helped environmentalists analyze industrial pollutants, employees evaluate the health and employment consequences of new production processes, and social workers better understand the life circumstances of disaffected teenagers. Thus while also forging U.S.-style collaborations with government and industry, the Dutch university system has found a way to more directly serve society as well.

Guston and Keniston emphasize science's traditional dedication to truth; others might counter that a more democratic science harbors the potential to advance the pace and breadth of understanding, technical invention, and socially responsive economic innovation. Surely any new and fruitful social contract for science will have to draw on a more nuanced account of science-society relations than that advanced by the authors.

RICHARD E. SCLOVE  
Executive Director  
The Loka Institute  
Amherst, Mass.

## OUR PLANET, OURSELVES

As Eric Chivian suggests in "The Ultimate Preventative Medicine" (*TR November/December 1994*), human population growth, environmental degradation, and emergence of infectious diseases are inextricably linked. Chronic problems such as drought, depletion of soil, and disappearance of fish from streams, lakes, and oceans draw humans to explore new territories or, more frequently, to join masses of others barely surviving in huge slums at the fringes of large urban centers. These areas tend to spawn infectious diseases, especially among newcomers who lack immunity



and adequate nutrition. Family movement between urban slums and rural areas transfers disease in both directions.

The size of displaced and migrating populations on the earth today is unmatched in human history. Although socioeconomic and political factors play potent roles, degradation of food and water supplies is the driving force behind many of the conflicts leading to such displacement. We tend to look outside ourselves for explanations, although we carry goods and continue to transport animals all over the world, use substances (antibiotics, chemicals, pesticides) that alter the microbial flora, and reduce biodiversity and alter ecosystems.

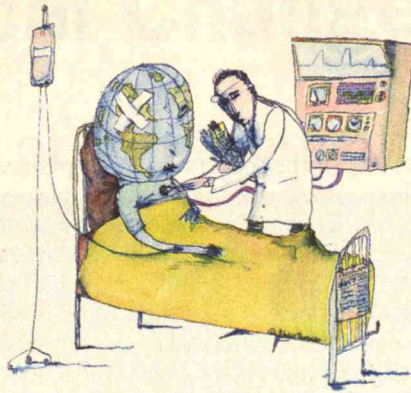
We must do a better job of educating individuals and institutions about the direct and indirect effects of environmental change on our health. The public responds to dramatic stories about streptococcal infections, malaria outbreaks, and cholera epidemics but we want a quick fix—a drug, a vaccine, a simple solution that will not interfere with lifestyles or consumption patterns. Any framework developed to guide both understanding and interventions must be global in scope.

MARY E. WILSON, M.D.

Assistant Professor  
Population and International Health  
Harvard School of Public Health  
Boston, Mass.

Dr. Eric Chivian's excellent article sounds a much-needed wake-up call not only to physicians but also to the general public as well. However, the ramifications of global environmental degradation on human health are, unfortunately, even more serious and complicated than he reveals.

In November 1991, the Union of Concerned Scientists released "Global Warning to Humanity," signed by more than 1,670 scientists, including 104 Nobel laureates. This document asserts that "great change in our stewardship of the earth and the life on it is required if vast misery is to be avoided and our global home on this planet is not to be irretrievably mutilated."



A panel established by the United Nations Environment Programme prompted this warning in part with its finding that "accelerating ozone depletion will have serious impact on most of the planet's life forms. For every 10 percent depletion of the ozone layer, we can expect a 20 percent increase in ultraviolet radiation arriving at the ground in life-damaging wavelengths. This radiation could change genetic structure, alter immune systems, damage crops, disrupt the marine food web, and enhance greenhouse warming."

Could this phenomenon explain the growing number of failing human immune systems, the soaring rate of cancer and infectious diseases, the diminishing effectiveness of vaccinations, expanding crop and forest damage, and escalating species extinctions? By eliminating the natural protections provided by our planet and our bodies, we are damaging ourselves and our environment.

Research is unmasking "environmental hormones"—chemicals and pollutants that disrupt biological processes, often by mimicking the effects of naturally produced hormones such as the feminine hormone estrogen. Scientists are observing the effects of reproductive changes in numerous species as these hormones render them sterile and, ultimately, extinct. This may explain why some human males in the industrialized nations are experiencing reproductive problems as well.

Although we are altering our planetary health from its original balance, we have yet to address the undeniable connection between our physical health and our planet's well-being. To continue to ignore this connection is to jeopardize the future.

KAREN HENDERSON  
Washington, Va.

I agree with Eric Chivian's view that environmental issues are health issues. I especially agree with his statement that "no discussion about the environment is complete without mentioning the central role of population growth in promoting environmental degradation." As Peter Berle of the National Audubon Society says: "World population growth and unsustainable production and consumption are the environmental challenges of our time."

I think overpopulation not only affects our environment and health; it is also the fundamental factor underlying our troubled economy, high crime rates, and difficulties achieving world peace. We must all take an active role in addressing population, both here at home and abroad. It can't be resolved instantly, but its impact will only worsen the longer the problem is pushed aside.

AVI ORNSTEIN  
New Britain, Conn.

## JUST REWARDS

I was greatly dismayed by the specious arguments and lack of rigorous analysis in "Distributing Our Technological Inheritance" (*TR* October 1994) by Gar Alperovitz. Socialist thinkers have long labored under the naive assumption that any single apportionment of wealth that exceeds the average is by definition obtained unjustly at the expense of society as a whole.

The reason that Bill Gates of Microsoft is worth so much money is that a finished product is worth infinitely more than the sum of its parts. Boolean algebra is not a computer operating system, steel is not an automobile, and the alphabet is not *Hamlet*.

Alperovitz favors a society in which a large amount of generated wealth is spread equally among those who added absolutely nothing to its creation. Such a system is not only unjust but also doomed to failure. Only in a free-market society is there sufficient enough incentive for an entrepreneur with drive, intelligence, and imagination to use our shared technological and cultural history to create new products and services. The



entrepreneur gets much richer than the average wage earner but also bequeaths far more to the human heritage.

ROBERT LEDER  
Brewster, N.Y.

You're undoubtedly familiar with those horrible letters to the editor that scream, "You published such and such. I am so angry I want to cancel my subscription immediately!" Well, I had that feeling when I read editor Steven Marcus's First Line (*TR January 1995*) on the overwhelmingly negative reaction of your readers to Gar Alperovitz's piece. My response was not provoked by the editorial or the original article, but by the realization that so many seemingly benighted people subscribe to the magazine.

Alperovitz gave a modest scholarly perspective on the accumulation of knowledge and asked reasonable and humane questions about the distribution of wealth on a planet where few exult and many starve. Yet he is excoriated as some kind of maniac.

Does the editor really feel the need to adjust the content of the magazine so as not to "get too far ahead" of such reaction? And even more disturbing is his statement that "we do not aim to convert you to any particular cause." What about the survival of the planet—how's that for a worthy direction?

Who are the readers for whom stimulation is irritation and surprises unpleasant? I would have thought your audience consisted of citizens concerned with the implications of the technology explosion. Instead, they seem to believe that the trenchant analysis of the consequences of capitalism and the necessity for organizing against injustice are passé or irrelevant.

Ministers are sometimes instructed to comfort the afflicted and afflict the comfortable. Groucho Marx and John Lennon, both cited by Mr. Marcus, did just that. Why can't *Technology Review*?

MARC ESTRIN  
Physician Assistant  
Student Health Center  
University of Vermont  
Burlington, Vt.

As one of the readers who complained about Alperovitz's article, I was pleased to see the editor's response to our concerns. However, he described the article as a "think piece" and not "a call to action." If the goal of the former is not eventually the latter, then why ruminate at all? Thought is the essence of action.

MILES ARNONE  
Woburn, Mass.

Considering the wealth Bill Gates has created for society, I disagree with Alperovitz's call to redistribute his personal income. Although Alperovitz is right to encourage generosity for humanity's benefit, I strongly feel the choice should belong to Gates and not the government.

GERARD MOSSERI MARLIO  
Marion, Mass.

### HONORING THE AGREEMENT

In "Kill the Whales?" (*TR November/December 1994*), Langdon Winner argues that Norwegians should give up eating whale meat so that one country's preference does not fatally undermine the whaling moratorium and become an excuse for other nations to similarly jeopardize cooperation on other environmental issues.

But, he fails to note that there are two environmentally sustainable policies on whaling. A preservationist policy would prohibit the slaughter of whales for any human purpose, whether food, lamp oil, or scientific research. The conservationist policy advocates the prudent exploitation of whales in a way that ensures the continued existence of the species. The arguments between preservationists and conservationists on whaling, as on other environmental issues, involve different visions of an ecologically viable future.

Many Norwegians (and Japanese) regard a complete moratorium on whaling as a repudiation of the original conservationist rationales advanced through the International Whaling Commission—especially as the scientific case for believing that all whale populations are threatened with extinction has eroded. While it is good to constantly try to improve environmental policies, efforts to recast basic

points of an agreement where consensus does not exist could increase the likelihood that governments will opt out and even become more cautious about making agreements in the first place.

M.J. PETERSON  
Department of Political Science  
University of Massachusetts  
Amherst, Mass.

### DATA'S DATE WITH DESTINY

I was delighted to read Terry Cook's "It's 10 O'Clock: Do You Know Where Your Data Are?" (*TR January 1995*). Cook does an outstanding job of explaining that the long-term access to electronic records presents questions that transcend media and even hardware longevity. At the center of the issue is the concept of a record as

incorporating information content, structure, and context to serve as evidence. By that definition, archivists realize that the majority of today's information systems are not record-keeping



systems. The University of Pittsburgh project Cook mentions provides specifications that, if incorporated into information systems, will ensure the creation of reliable and authentic evidence.

My own organization, the National Historical Publications and Records Commission (NHPRC), is proud to support the University of Pittsburgh project. As a funding agency that is part of the National Archives and Records Administration, the NHPRC sustains a variety of work in archives across the country and has considerable interest in supporting projects that tackle electronic records issues. We invite your inquiries and can be reached at NHPRC, Room 607, National Archives Building, Washington, D.C. 20408, (202) 501-5610.

LISA WEBER  
National Historical Publications and  
Records Commission  
Washington, D.C.



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# MIT Reporter



## THE INSIDE STORY ON SPINES AND BONE

 Amid a campus replete with high-tech centers, Lorna J. Gibson offers a simple porcupine quill to a visitor, then the rounded end of a human hip bone. And she points to a microphotograph of a cross section of a grass stem. Gibson, an associate professor in the departments of Civil and Environmental Engineering and Mechanical Engineering, analyzes the structures of such objects to predict how much pressure they can withstand before they deform and fail. Much of her work is aiding biomimetic research, the effort to copy natural structures that have outstanding mechanical properties for their weight. Her studies could be used to help develop stronger engineered structures.

Using charts indicating rough mechanical similarities among various materials, Gibson and her students have chosen to concentrate on a few natural structures. With Gebran N. Karam, who has worked with her while completing a PhD and during a postdoctoral fellowship, Gibson has examined the quills and spines of nine animal species, as well as the stems of nine kinds of grasses and

*Lorna J. Gibson holds a balled-up European hedgehog, whose spines are outstanding in resisting mechanical load. Analysis of spines, quills, and other natural materials might be useful in engineering stronger structures.*

grains. Working with both longitudinal and cross sections, the team has measured the density, stiffness, and thickness of the cores and outer walls of these materials, then run tests on physical models made of silicone rubber. Analytical models—geometrically descriptive equations—have also been critical in determining which materials best resist mechanical load, both vertical stress and force exerted from the side, for their weight.

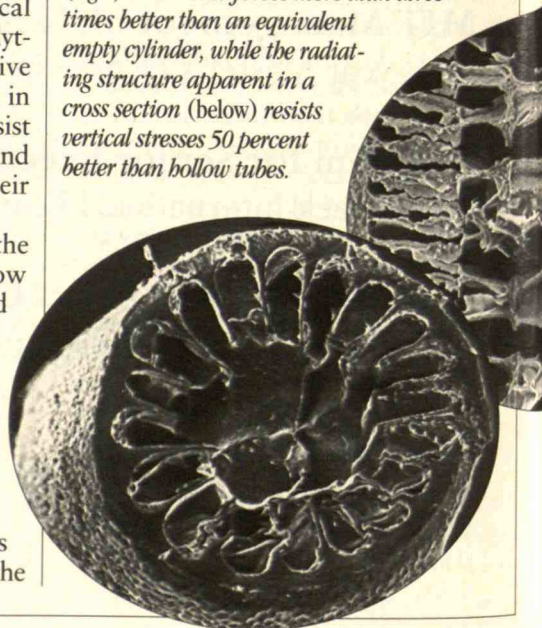
Comparing their findings with the results from similar trials on hollow tubes, the researchers have determined that the spines of the hedgehog of Europe and a hedgehog of the Middle East offer resistance more than three times that of the equivalent empty cylinders to forces applied from the side. Longitudinal sections of these spines reveal a honeycomb of four-sided fiber “boxes.” This structure is relatively compliant and so protects the

spine from buckling. European hedgehog spines also do 50 percent better than hollow tubes in resisting forces exerted straight down. The cross section of a European (or, for that matter, a Middle Eastern hedgehog) spine is reminiscent of that of grapefruit, with thin, fibrous structures radiating throughout the material. This structure, which is neither too stiff nor too flexible, helps the spine resist permanent crumpling.

Possible long-term applications for such findings include producing metal tubes whose walls surround an inner network of open cells bounded by plates or struts, a design that could be used to strengthen aircraft fuselages, missile shells, crop silos, and legs for offshore oil structures. Gibson says that the knowledge might even be useful for agronomists trying to breed for better mechanical resistance in wheat and barley, plants that sometimes buckle under heavy winds, leaving the fallen grain difficult to harvest.

Gibson is now studying how plant stems partly rely on internal pressure, which in their case comes in the form of water, to withstand mechanical stress. One application might be development

*The honeycomb of fibers seen in a longitudinal section of a European hedgehog spine (right) resists side forces more than three times better than an equivalent empty cylinder, while the radiating structure apparent in a cross section (below) resists vertical stresses 50 percent better than hollow tubes.*





of beams that could be inflated—but with air—and deflated at will. The U.S. Army has expressed some interest in this idea for developing portable housing and other structures.

### Osteoporosis Research

Ilhan Aksay, a professor in Princeton University's Chemical Engineering Department and at the Princeton Materials Institute, points out that while researchers have previously proposed using "biomimicked" materials for various manufactured structures, Gibson is playing a "key role" because knowledge of natural materials "was not as quantitative as it should be." Still, many biomimetic applications may take some time in coming, says Stephen A. Wainwright, a zoology professor at Duke University, because of difficulties in developing the means to exactly and efficiently reproduce all the features in natural materials.

Meanwhile, Gibson is also conducting research that could have implications for people with osteoporosis, a disease primarily affecting older women in which the body's loss of bone mass can lead to debilitating hip fractures and other painful conditions. With doctors in the Orthopedics Biomechanics Laboratory at Boston's Beth Israel Hospital, she is analyzing the structure of the uppermost portion of the human femur bone—the ball that fits into the socket of the pelvis. Using a computer simulation of the ball's interior, which resembles hardened foam, doctoral student Matthew Silva has found that a loss of just 3 percent of the struts leads to a 30 percent reduction in mechanical strength. The research, Gibson says, could help determine who should wear hip pads now being developed that would shunt the impact from falls away from the femur.—LAURA VAN DAM

### SPINNING A BETTER WEB



Opening a booth in the vast electronic mall known as the World Wide Web is fast becoming one of the hippest ways to reach customers and constituents, to judge by the actions of a growing cadre of businesses, government agencies, universities, and other organizations. The newest segment of the global Internet, the Web lets users wander by clicks of a computer mouse among thousands of custom-designed multimedia documents stored in linked computers. But as the system grows, it's encountering some very old-fashioned headaches: the mall's parking lot is full, pickpocketing is a constant hazard, and there's no directory for orienting oneself.

Worse still, the response to these difficulties could lead to a broader problem: the development of software and data that don't share underlying protocols. This would wall off certain portions of the Web to many users, even though the idea that all documents should be available to all users—in Web lingo, "interoperable"—is a key Web feature.

In 1990, researchers at the European Laboratory for Particle Physics (better known by its French acronym CERN) set up the Web as a way for high-energy physicists to keep abreast of one another's progress. The idea was that one physics team might create a Web document, or "page," of text using an article or set of data, noting somewhere within the text the existence of, say, a corresponding graphic set up as a separate page in the system. After starting up a program to browse for Web pages, a user could find and read the text and then retrieve the graphic by clicking on the "link" to it (the link, in the form of a word, phrase, or icon, would be highlighted). The user might wish to correspond about the information by electronic mail with the original team, or might develop additional Web documents—which could also take the form of color photographs, sound, and animation—that perhaps could be linked to the original text page by the same highlighting process.

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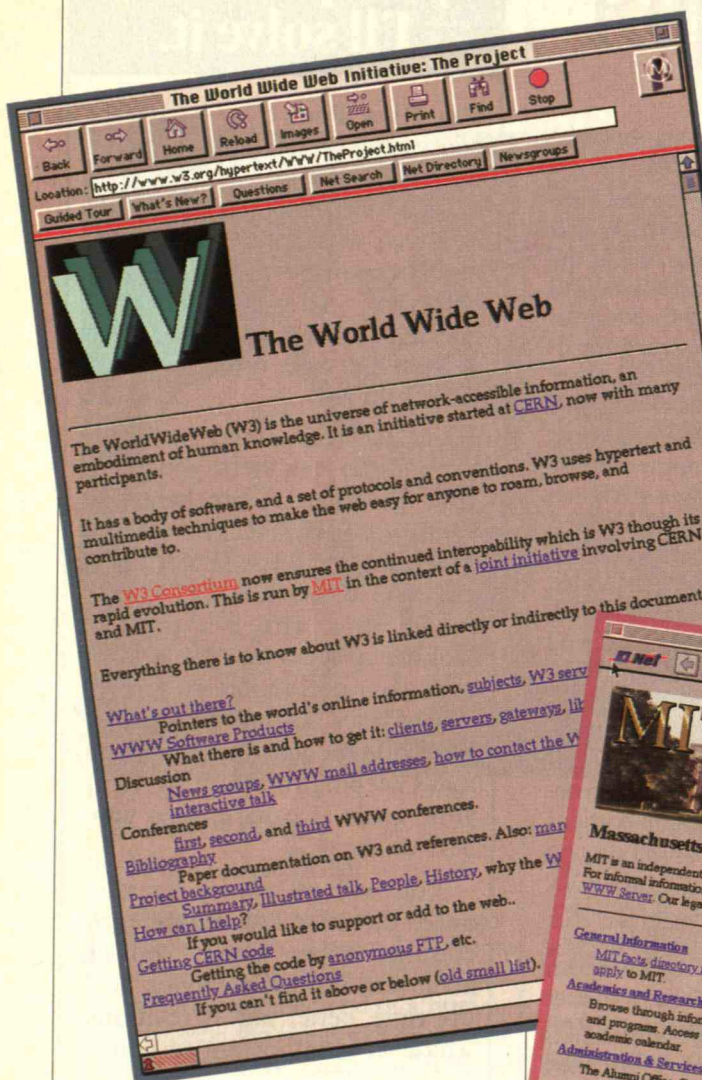
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*The World Wide Web Consortium, based at MIT, is developing standards for designers of documents and software for the Web segment of the Internet. Here two Web "pages" show "links"—underlined words and phrases—that a user can click on to open other pages (such as the "MIT" link on the page entitled "The World Wide Web").*

The creation of Mosaic, a program that with colorful, "windows"-style graphics makes browsing through the Web easy and enjoyable, has fueled an explosion in Web use and development far beyond that envisioned by the original scientists. The public is starting to use the system to find documents posted by businesses and other organizations describing, say, how to order flower

bouquets electronically or apply for admission to a particular university. Realizing that the Web can be valuable in helping to make sales, many companies are creating online catalogs and advertising to entice thousands of computer-literate (and upscale) customers each day while avoiding

message from President Clinton—sometimes take minutes to transmit or fail altogether. In part, the slowness relates to the number of requests individual Web servers can handle at once. Also, the multimedia nature of many Web documents requires enormous amounts of data, making gridlock a bigger problem for Web users than for users of other parts of the fast-growing Internet.

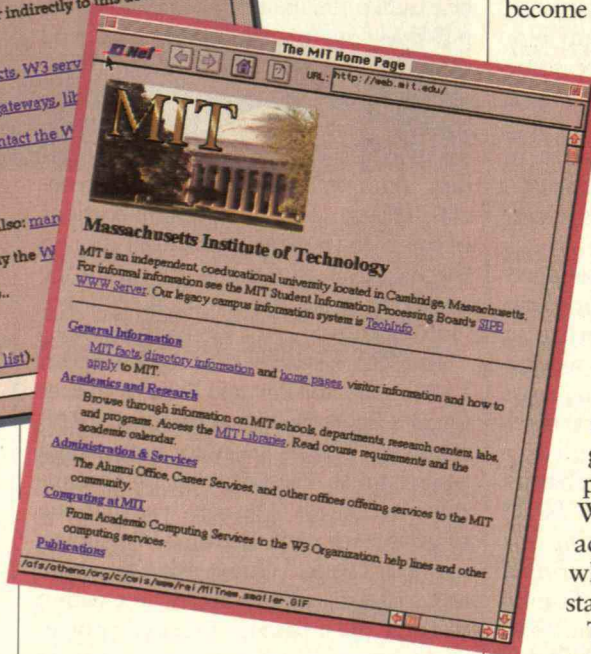
There's also mounting concern that the system needs programs to secure sensitive data, such as customers' credit-card numbers, against interception and decryption by computer intruders. While malicious hacking has not yet become a problem on the Web, develop-

ers are acutely aware that no other part of the Internet has been spared the wrath of criminally motivated hackers.

Users also see the value of developing programs that essentially offer a "Yellow Pages" for the flood of information available on the Web, since searching it now for particular documents can be painful or even impossible. But the creation of various programs with different underlying protocols could result in the Web's fragmentation and decay, according to Tim Berners-Lee, who created the Web's original standards while a CERN member.

To address these difficulties, a group of software, electronics, and communications companies founded the World Wide Web Consortium (W3C) this past October. Headquartered at MIT's Laboratory for Computer Science (LCS), the consortium, which now has about two dozen members including IBM, Digital Equipment, Hewlett-Packard, MCI, Lotus, and Microsoft, is using membership dues to fund work on a long list of technical protocols useful both for designers of Web documents and for software companies hoping to create new ways for users to retrieve and manipulate these documents.

"People were arriving unannounced



the high costs of traditional marketing through print and broadcast media.

With the boom in use, the number of Web servers—the computers that handle requests for Web documents—has grown from only 130 in mid-1993 to well over 10,000 today. But the rapid pace of development is leading to traffic-control and other problems. For example, while requests for materials are usually answered within seconds, popular Web documents—such as the White House home page, which includes photos of the First Family and a recorded



in my office at CERN demanding that we form the consortium," recalls Berners-Lee, who now directs W3C. "Companies investing larger and larger amounts of their own resources into the Web, or into work that relies on the Web, wanted to know that it would still be there, still interoperable, in 20 years."

Berners-Lee says he chose to base the consortium at MIT because a large number of Web-related research projects are already underway there, and because the effort is similar to the X Consortium, an MIT project in which researchers worked with industry to develop and release at no cost X Windows, a widely adopted point-and-click user interface for workstation computers. Similarly, starting in early 1996 the W3C group plans to release its standards free of charge to Web document developers and software companies writing Web-related programs. Small task forces of specialists are beginning to divide W3C's work. Staff from the consortium's corporate members plan to visit MIT's computer-science lab frequently to monitor progress and contribute their own expertise.

### Setting up Traffic Rules

One W3C group hopes to alleviate traffic problems. The task force intends to develop protocols for storing frequently requested information at multiple locations and ensuring that data follow the shortest possible path to their destinations. Albert Vezza, associate LCS director and one of W3C's organizers, points out, "Right now, you can't even tell that a request has come from a particular geographic area. It may go all the way around the world to get answered." He adds, "There have to be enough smarts in the protocol to know how to get to the closest computer that can answer it."

A group of prospective members of the consortium's task force on security, privacy, and authentication has already met, concerned about devising protocols for programs that deal with securing commerce, such as online catalog shopping and orders for journal subscriptions

over the Web. The group also wants to develop standards related to software techniques for authenticating the identities of both buyer and seller. To prevent credit-card fraud and other forms of theft, the server should give verifying information about individuals, explains Berners-Lee. Information on possible underlying protocols isn't yet available.

Another team will be charged with creating protocols for software to help people search for specific topics in Web pages. Standards are needed for programs such as several under development that, according to Suzana Lisanti, campus-wide information systems facilitator at MIT, generate and update daily for each Web page a customized index of subjects addressed. The index would function as a kind of electronic headline and could contain key words designed to help a person decide whether to read particular pages.

As W3C's technical work gets under way, Berners-Lee says one of his most important tasks will be to balance the competing visions of its corporate members, each of whom has a financial stake—as a software developer or information provider—in the shape of the eventual Web standards. For example, Mosaic Communications, a California firm that sells an enhanced version of the original Mosaic program, stands to gain a competitive advantage over other consortium members if the new protocols incorporate some of the company's software innovations, while other members will be just as eager to see their ideas used. But Berners-Lee says his experience at CERN in editing the original Web specifications has taught him to be optimistic that such conflicts can be overcome simply through directed discussion. The members will resolve their differences because, he says, everyone stands to gain from the system's "overriding, essential nature"—that every Web document is available to every user.

—WADE ROUSH

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# Trends

## Preserving Movies

Hold on to memories of your favorite movies. Someday they may be all you have, because the nation's storehouse of motion pictures is decaying at an alarming rate. The earliest films have all but vanished: Less than 10 percent of the films made in the 1910s still exist. More than half of all feature films made before 1950 have deteriorated. Even films shot from the 1950s to the 1980s are likely to have faded, says Gregory Lukow, director for administration of the National Center for Film and Video Preservation at the American Film Institute in Los Angeles. "You can't go to a theater and see a good-quality print of a film made in that era."

"The basic problem," says Michael Friend, director of the film archives at the Academy of Motion Picture Arts and Sciences in Los Angeles, "is that film itself was never designed to be a medium for long-term storage," especially one that could withstand repeated use.

Early motion picture film was made of cellulose nitrate, but that material can spontaneously burst into flame at temperatures as low as 112° F. Since 1950, filmmakers have instead used so-called "safety film," an acetate-cellulose film that is not flammable. Laboratory simulations originally predicted that safety film would last longer without the nitrate used in the earlier medium, but experience has shown that the acetate film degrades just as fast. Preservationists even have coined a name for the deterioration: the "vinegar syndrome," a reference to the vinegary smell produced as acetate gradually deteriorates.

So what's to be done? Most preservationists think that the best solution, at least in the short term, is to store film under better conditions—at temperatures below 55° F and at less than 45 per-

*By digitizing every frame of Snow White and the Seven Dwarfs, Walt Disney Studios was able to use a computer to correct colors, eliminate the dust speckles and scratches on the original 1937 film (top), and produce a spanking new print (bottom).*

cent relative humidity. At higher temperatures, cellulose reacts with the coatings and other substances in the film, and higher humidities accelerate the chemical reaction. James Reilly, director of the Image Permanence Institute at Rochester Institute of Technology, says improved storage would extend the life of fresh acetate film by several hundred years and older film by 50 years.

Concentrating on better storage conditions is a major break from the past approach, in which archivists simply made copies of original films before they deteriorated too badly. But preservation-

ists are waking up to the fact that copying is no sinecure: as anyone who has made a photocopy of a photocopy knows, a copy is never as good as an original. Each copy of a film is similarly of slightly poorer quality than the original. And copying is expensive, costing \$40,000 or more.

Some preservationists see cyberspace as offering a longer-term solution to the film-preservation problem. In Friend's conception, films would be stored digitally, with each frame broken down into smaller portions and translated into a series of numbers for storage in a massive computer file. Whenever a new print of the film was needed, the computer could crank one out with no loss of quality. But the storage requirements would be truly massive: Friend estimates that a 90-minute feature film might require 7.5 terabytes of storage

space, the equivalent of 5.2 million floppy disks.

This information, at least at present, could be stored on magnetic tape, which may be no more suitable for long-term storage than acetate film. Yet Friend is confident that because of the huge demand for improved long-term storage of all types of computer data, technologists will develop longer-lived electronic storage media.

Walt Disney Studios already has taken the digital approach with its 1993 re-release of the 1937 animated classic *Snow White and the Seven Dwarfs*. Engineers made a digital copy of every frame in the original film, used the computer to eliminate numerous defects that had crept into the original film, and then employed a special film-producing machine to generate a spanking new print of the digital file.

At present, such sophisticated pro-



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cessing doesn't come cheap. Disney is rumored to have spent more than \$3 million restoring *Snow White*. Cash-strapped archives could never afford to spend that much on film preservation, so most projects aim to create just the digital copies needed to repair only the most obvious defects—for instance, segments of torn film—which may involve only a few frames.

To further advance the industry's efforts, the National Film Preservation Board outlined a five-year plan for enhancing U.S. film preservation. Besides calling for improved storage conditions, the board cited the need for alternatives to two chemicals essential in film preservation today. One is 1,1,1-trichloroethane, which is used to clean a film before copying. Because trichloroethane attacks stratospheric ozone, it faces elimination this year under the Montreal Protocol. The other is the carcinogen perchloroethylene, which is used in the film-printing process.

Another challenge is in developing technical standards for what exactly is to be preserved. Such efforts are now more art than science, with individual preservationists deciding on their own, for example, whether a copy faithfully reproduces a film's color. The board proposes that representatives of studios, archives, and film laboratories review a

range of preserved films to devise the needed standards.

Whether preservationists focus ultimately on building low-temperature vaults for storing films or sophisticated computers that will store them digitally, the biggest hurdle may not be technological but economic: How much money is needed? And where will it come from? The film preservation board last year recommended that the federal government create a foundation that would match public funds with private donations, much like the National Fish and Wildlife Foundation created by Congress in 1984.

To build congressional support for such a program, the Library of Congress is staging a National Film Registry Tour in 10 cities around the country, showing fresh prints of classic movies struck from the original negatives. Even the best of the negatives have suffered some of the ravages of time. But unlike most old films that the public is used to seeing, the new prints at least do not exhibit the dirt, scratches, color fading, and poor sound quality that results from repeated use. By showing more of what the filmmakers intended decades ago, promoters hope the "oohs" and "aahs" from the audience will help convince their elected lawmakers to reach for their checkbooks.

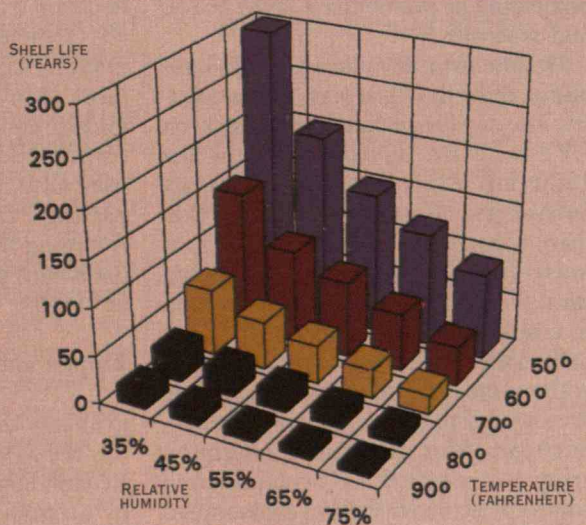
—VINCENT KIERNAN

## Smoother Shifting

The concept of equipping automobiles with a continuously variable transmission (CVT), providing an unlimited number of gear ratios instead of the 3, 4, or 5 gears that conventional transmissions offer, has been around nearly as long as cars themselves. In 1886, German automotive pioneers Daimler and Benz fitted their first gasoline-fueled car with a CVT. But over the decades automakers have continually refined conventional gearbox designs while building huge plants to mass-produce them. CVT technology for cars has languished in the meantime.

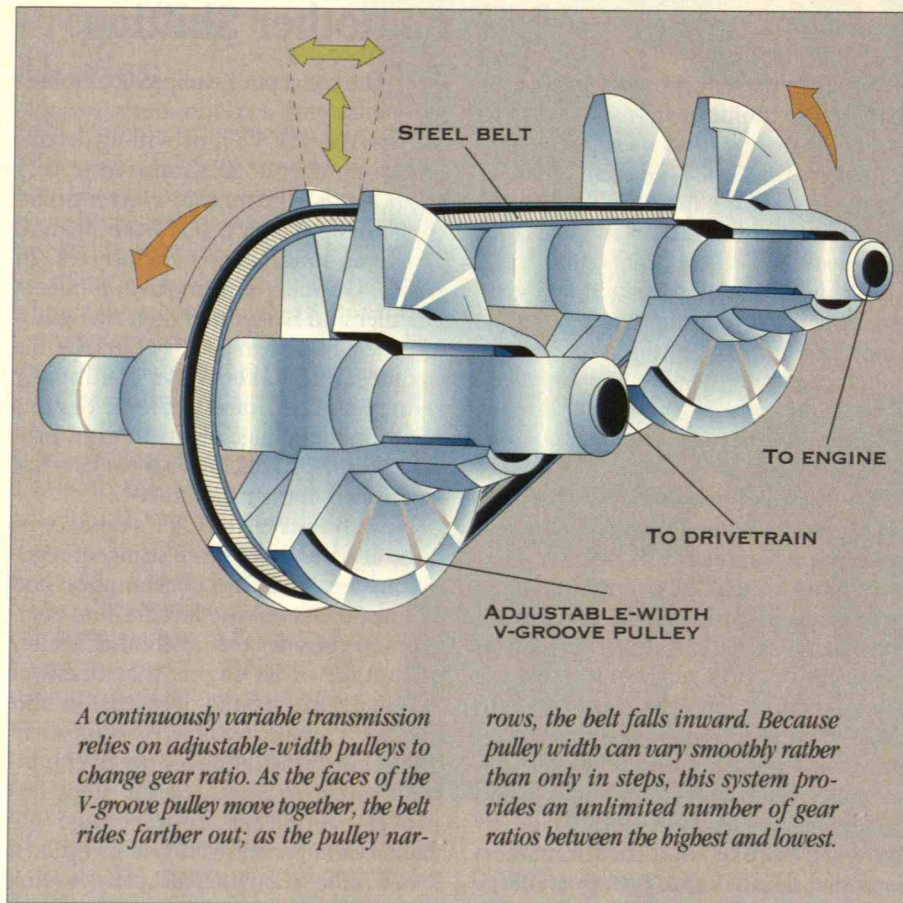
Now, however, the CVT's time seems to be at hand. Ever-more stringent regulations regarding fuel consumption and exhaust emissions are forcing auto engineers to consider the inherent efficiency advantage of an engine that operates within a narrow band of speeds—a trait that CVTs make feasible. The ability to adjust gear ratio along a smooth continuum rather than in discrete steps improves overall efficiency because the engine can operate steadily at its optimal speed rather than intermittently revving up and slowing down—the fuel-wasting procedure that conventional transmissions require. Thus drivetrains with the latest CVTs offer better fuel economy than those operating with conventional gearboxes.

A conventional transmission, whether manual or automatic, transfers power from the engine to the drivetrain using gears of varying sizes. A CVT, by contrast, relies on a belt-and-pulley system. The inner faces of the pulley sheaves angle inward to form a V-shaped belt groove. A computer-controlled hydraulic system pushes the pulley sheaves together or draws them apart, forcing the steel belt to ride farther out or farther in from the shaft. This increases or decreases the pulley diameter, and makes possible continuous, rather than step-wise, adjustment of the "gear" ratio, which determines the relationship between the speed of the engine and the speed of the wheels.



*Film can be safely preserved for hundreds of years if kept cool and dry. Higher temperatures and humidity accelerate a reaction between the cellulose and chemicals in the film, producing rapid deterioration and a tell-tale vinegary odor.*





As any serious bicyclist knows, it is more efficient to pedal at a steady cadence, changing the gears when necessary, than to regularly speed up and slow down the pedaling rate. In large measure, the same is true of an automobile drivetrain. Moreover, CVTs can provide a larger span of gear ratios than can a conventional gearbox of practical dimensions, which is typically limited to five forward gears. At a given engine speed, the wheels will turn about five times faster in fifth gear than in first gear. Extending this span requires additional gears. But extending the gear-ratio span on a CVT requires no additional parts—only a bigger pulley. Van Doorne, the Tilburg, Holland, company that developed modern CVT technology, is working on a CVT with a span of ratios greater than six to one. To cover this wide a span without leaving big gaps

between gear ratios, a conventional transmission would need eight gears of incrementally larger sizes. Such a gearbox would be prohibitively large, heavy, and expensive.

Despite their advantages, CVTs have been a difficult sell, at least in this country. The most recent attempt to market a CVT car in the United States—the late 1980s introduction of the subcompact Subaru Justy—was not a success. U.S. drivers perceived the Justy's CVT as noisy and sluggish. From a standing start, the car's engine speed would jump to a relatively high, constant rpm, yet the vehicle would creep forward slowly, without the forward jolt that drivers are accustomed to with conventional transmissions. This peculiar acceleration arises because the CVT's computerized control system manipulates engine speed as well as gear ratio. Stepping on the gas

doesn't necessarily rev the engine; depending on the conditions of the moment, the computer may instead respond by raising the gear ratio while keeping the engine speed about the same. The result is lower fuel consumption. The car still accelerates, but it feels different—and to the unaccustomed driver, somehow wrong.

Worldwide, CVTs are already powering more than a million cars, including Fiats, Fords, Nissans, Subarus, and Volvos. These CVT units are manufactured primarily by Fuji Heavy Industries Ltd. and Ford of Europe, using technology licensed from Van Doorne. Burdened with higher gas prices, European and Japanese drivers are more willing than their U.S. counterparts to tolerate changes in the way a car performs in order to improve efficiency. "We believe that the future of the CVT lies in its fuel economy," says Bill van Schaardenburgh, manager of special project operations for Ford of Europe. And Honda is also reportedly betting on CVT technology; the Japanese carmaker is said to be planning to bring a CVT-equipped Civic sedan to U.S. shores in 1996.

CVTs are now used in small cars. But Van Doorne engineers are developing more advanced units for larger, more powerful vehicles, with a stronger belt to transmit the higher torque and a more powerful, more precise hydraulic system to clamp the belt into place. In addition, ZF Getriebe, the German transmission manufacturer, has recently invested more than \$32 million on a CVT for midsize cars that is expected to cut fuel consumption by 10 percent, says Siegfried Goll, president of the company's passenger car transmission division. ZF is aiming for annual sales of 200,000 units with production starting in 1997 or 1998.

### Zipper and Smarter

Probably the most impressive new use for the CVT is the Canon-Williams Renault Formula One race car, powered by an 800-horsepower Renault V-10 engine. The CVT "can make smoother



gear changes than I can," says Williams test driver David Coulthard. This car is not now racing, however, because 1993 rule changes banned the use of CVTs and other "driver's aids" on the Formula One circuit.

Van Doorne researchers are now focusing on improving the CVT's ability to accelerate from a full stop. Van Doorne has installed a new CVT design in two Chrysler minivans, which can accelerate from 0 to 60 mph a full second quicker than vans using conventional transmissions, according to Emery Hendriks, Van Doorne's general manager for R&D. This zippier performance stems at least in part from the use of a torque converter—a device, similar to those in conventional automatic transmissions, that uses the force of a fluid moving against enclosed turbine and stator wheels to boost output torque. In the CVT vehicles, the torque converter helps provide more of the "kick-in-the-pants" acceleration that American motorists expect.

Meanwhile, companies such as Porsche, Bosch, and others are focusing on improving the computer controls that integrate engine and transmission management in next-generation CVTs. By more precisely fine-tuning engine speed and gear ratio to handle constantly changing driving conditions, this control system will allow motorists to accelerate continuously at full power at an efficiency not possible with conventional drivetrains, says Max Welty, director of the Porsche race department.

Such a system could also adjust the transmission to adapt it to the driver's style. If the car makes a series of quick turns, for instance, the control system could switch to a "sporty" mode, instructing the CVT to linger longer in the low gear ratios that provide maximum acceleration. The CVT, says Welty, "offers the best chance to resolve the conflict between more power and greater fuel economy. I'm convinced that the future will belong to the CVT not only in racing cars, but in high-production models as well."

—STEVEN ASHLEY

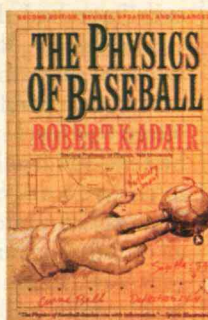
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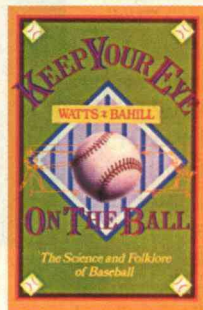
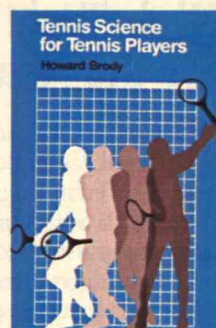


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## High-Tech Help for the Nearsighted

Until three years ago, Randy Frey's small, Orlando-based firm, Autonomous Technologies, worked for the Pentagon's Star Wars program, developing a sophisticated computer-tracking system to target incoming missiles. Now the firm is focusing the technology on a more pervasive enemy: nearsightedness.

With the announcement last year of a partnership with the giant Swiss pharmaceutical firm Ciba-Geigy, Autonomous Technologies became the latest entrant in a growing medical field called photorefractive surgery, which uses lasers to correct vision. By adding sophisticated computer-driven eye-tracking systems, firms such as Autonomous Technologies are creating a new generation of laser-surgery systems they hope will prove more accurate and effective than the first-generation systems now reaching the market worldwide.

Photorefractive surgery is already yielding an advance for the visually impaired unrivaled since the introduction of eyeglasses in Europe in the thirteenth century. The idea is that people suffering from less-than-perfect vision—mainly nearsightedness—visit a local specialist who uses a laser beam to remove tiny, submicron-thick layers from their corneas, reshaping the curvature of the eyeballs. The technique accomplishes the same kind of correction to their vision now only widely available from eyeglasses or contact lenses. It requires no general anesthesia. The entire laser procedure takes only seconds. And it offers permanently corrected vision.

### Market Visions

If this sounds like science fiction, a study conducted by the consulting firm Arthur D. Little says otherwise, claiming that more than 500 lasers for refractive surgery have already been installed worldwide (though not yet in the United States), and more than 200,000 human

eyes have had their vision corrected by lasers. The vision of more than 90 percent of the patients was corrected to a level of 20/40 or better—the legal standard to receive a driver's license in most U.S. states. Almost all of the remaining 10 percent saw some improvement but still needed glasses. And no patients have had their eyesight significantly impaired by the procedure.

One first-generation system for refractive surgery developed by Summit Technologies of Waltham, Mass., has already won conditional approval last fall from the Food and Drug Administration for use in the United States. Lawrence Haimavitch, president of a San Francisco-based consulting firm that analyzes markets for emerging medical technologies, says the nine-year regulatory route taken by the early front-runners in this emerging technology has been "tortuous." But he anticipates that two systems—those offered by Summit and competitor VISX based in Santa Clara, Calif.—should be fully approved by the end of this year.

The U.S. market for such a device is potentially huge. Half of the population—more than 125 million people—wear corrective lenses. Of these, some 60 million are nearsighted. Irving Arons, an engineer recently retired from Arthur D. Little who has specialized in analyzing developments in ophthalmic and other medical lasers for a decade, projects that some 5.5 million people will undergo laser treatment within the next five years at some 1,200 practices around the country. He expects that a decade from now no less than 10 percent of the U.S. "vision care population" will have undergone the procedure.

Although many in the field contend that lasers will be able to treat vision problems such as farsightedness, astig-



*A highly sensitive motion detector—adapted from Star Wars missile-tracking technology—can be used in laser eye surgery to lock onto a patient's pupil and read even the slightest movements. The laser beam can be adjusted accordingly to enhance surgical precision.*

matisms, and even glaucoma, the emphasis so far has been on nearsightedness, or myopia. In normal vision, the eye's lens and the cornea bend—or refract—the light passing through them to focus the rays sharply on the retina. But in myopic eyes, the cornea and lens bend the light too sharply, focusing distant images in front of the retina rather than upon it—in essence, the eyeball is too long. Consequently, corrective lenses for myopia are concave. Thicker around the edges, they spread the rays of light before they reach the cornea to move the focusing point back farther toward the retina.

The laser technique, officially called photorefractive kerotomy (PRK), takes a different tack: the laser beam va-



porizes tiny layers of tissue from the center of the cornea to reshape it. The reshaping, known as corneal sculpting, accomplishes the same end as corrective lenses—restoring visual acuity by causing rays of light to focus more sharply on the retina.

During the procedure, rapid pulses of relatively weak ultraviolet laser light are aimed at the portions of corneal tissue to be removed. Because many repeated laser pulses are required to

still by focusing on a fixed point of light. Autonomous Technologies is one of roughly a half-dozen firms developing computer-driven tracking systems to address these drawbacks. The firm is conducting clinical trials in Europe and the United States and hopes to have FDA approval for the new technology within two or three years.

The system uses sophisticated software and a radarlike detection system that locks onto the patient's pupil and uses the rapid pulses of laser light to "read" even slight involuntary and irregular "saccadic" eye movements that occur constantly—even during the laser procedure. The tracking system can adapt extremely rapidly to the eye's position and adjust the laser beam accordingly. Because of the potentially increased accuracy, the technique allows the use of a much narrower and more powerful beam that can potentially sculpt the cornea with more precision.

The biggest difficulty Frey's firm has encountered in tracking eyes compared with missiles, he says, is that the eye is "much faster than any object I've seen tracked in the military." Because eye movements occur within roughly 10-20 milliseconds, tracking equipment such as video cameras "just don't hack it," he says, because they cannot record—or detect—movement faster than the 60-cycle-per-second speed at which they operate. To solve the problem, Frey's firm adapted a type of radar system designed for the Star Wars program that uses rapid-strobing laser light instead of sound and a computer system that can handle large amounts of data at speeds of many thousands of cycles per second.

On the other hand, Frey says, some things were easier in designing a laser tracking system for eyes. One of the biggest challenges of the Star Wars program was the requirement that a system be able to consistently detect an incoming missile in a vast sky. Or as Frey puts it, in the jargon of the military: "To get your kill, you first had to acquire the target." In his new field, Frey says, "acquiring the target is easy."

—SETH SHULMAN

## High-Tech Help for the Blind

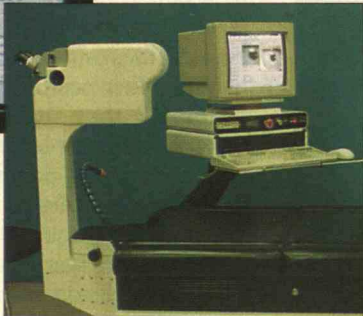
Long canes and seeing-eye dogs may work wonders in helping blind people avoid obstacles, but they are useless at providing clues about what lies beyond an individual's immediate environment. Now a triumvirate of researchers is developing a sound-based navigation device that, by giving the visually impaired a virtual acoustic view of their surroundings, could someday offer them the same freedom of movement sighted people enjoy.

The idea of a navigation system for blind people first came to Jack Loomis, a perceptual psychologist at the University of California at Santa Barbara, back in 1985. Loomis had been developing 3D computer-animation systems and using flight simulators for his own pilot training when it occurred to him that such virtual environments could be created with sound.

He ran his idea past Reginald Golledge, a geographer at the university who had recently lost his sight from a degenerative disease of the optic nerve. Golledge, as if in unconscious preparation for his new life, had spent years studying how people create mental maps of their environment. Intrigued, he and Loomis formed a research group with Roberta Klatzky, a cognitive psychologist now at Carnegie Mellon who has studied the abilities of both blind people and blindfolded sighted people to navigate by dead reckoning.

The tangible result is what the researchers are calling their "personal guidance system." In its current form, the 28-pound backpack unit looks like a Rube Goldberg contraption, complete with straps, headphones, and a laptop computer hanging off the back. But even in this inelegant prototype, the system is a good example of cross-disciplinary thinking.

"The investigators are taking advantage of three advanced technologies in an innovative way," says Michael Oberdorfer, branch chief of the Visual Pro-



remove even a micron of tissue, the surgeon can stop the beam before it penetrates interior portions of the eye or creates enough heat to damage surrounding tissue. The surgeon also has time to halt the procedure if the patient's eye moves off center from the laser.

The only major side effect is a temporary haze of the cornea that is almost always so minor that the patient cannot detect it. In some 700 people treated with the Summit Technologies laser system in an FDA clinical trial, no patient had corneal haze marked enough to cloud vision at a follow-up examination a year after the procedure, and such haze was entirely absent in 62 percent of all cases.

First-generation systems are limited in that they use relatively wide beams, which inhibit sculpting precision, and they require patients to keep their eyes



cessing Program at the National Eye Institute, which is funding the research. The principal technologies are global positioning using the military's space-based satellites, a computer-based geographical information system, and a virtual acoustic display.

To explain how the invention works, Golledge described a recent walk he took through the Santa Barbara campus. "The route started in a vacant parking lot, went between buildings, around the corner of the library, under some trees, across a road, along a sidewalk, and back across campus to the library," he recalls. "To complicate matters, we also threw in some curved pathways."

As Golledge walked along, the global positioning system (GPS) monitor mounted on his back continually triangulated signals beamed down from whichever of the military's complement of 24 orbiting GPS satellites were then overhead. With standard GPS, this would have told Golledge where he was on the earth's surface to within 100 meters. But the team uses differential GPS, which adds a fixed, land-based signal to the mix and hones the accuracy to just a meter or two.

As he made his way through the campus, Golledge's location was continually relayed to the computer's geographical information system (GIS), which contained a highly detailed map of the Santa Barbara campus, including individual buildings and roads. (If available, GIS maps of any spot on earth—from midtown Manhattan to a cornfield in Iowa—could be installed.) Using the GPS signals, the computer kept track of

Golledge's position on the GIS map. Simultaneously, an electronic compass mounted on the headband of his earphones delivered precise information about the orientation of his head.

approached or moved away. Other objects announced themselves from their respective locations in the same manner.

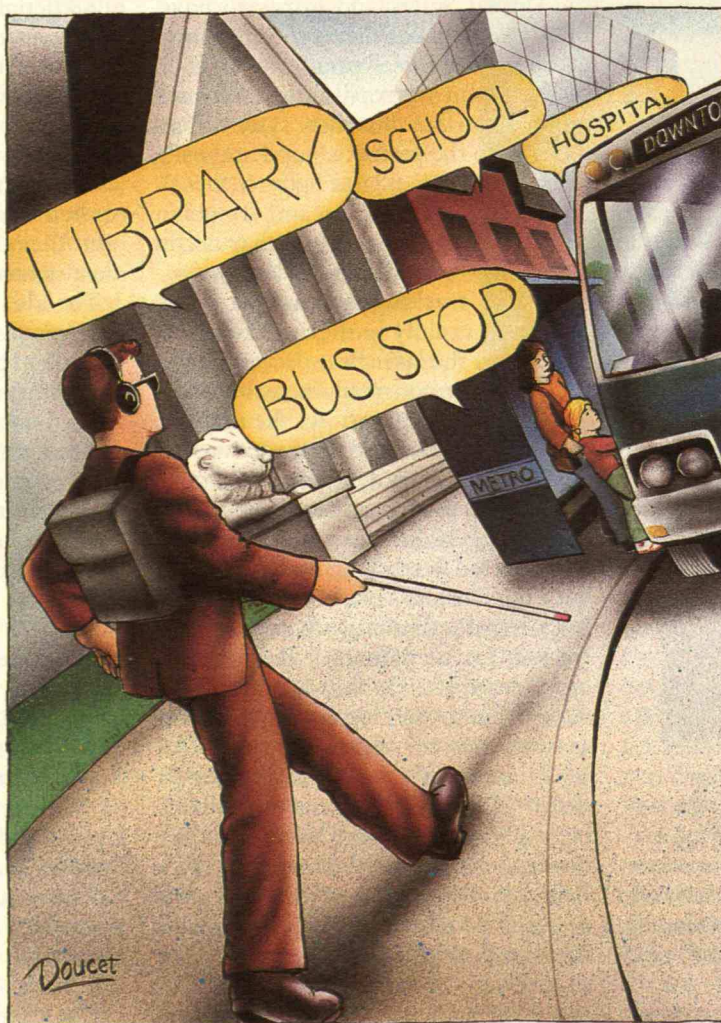
Despite its promise, the guidance system has several drawbacks. The most

intractable is that buildings and large trees can block GPS signals, including the differential signal. "GPS will work well in the cornfields of Iowa, but you can bet it won't work in midtown Manhattan," Loomis admits. Even when triangulation is possible, reflections known as multipath distortions can ricochet off buildings and nudge the positioning off by as much as 20 meters, he says.

To overcome that obstacle the team is investigating other positioning systems that could replace or supplement GPS, such as a radar signal like that used in Loran (long-range navigation) systems on board ships, which could be installed in key locations throughout major cities. Team members are also looking at ways to keep a user moving along safely until a lost GPS signal can be regained. For example, the computer could update the user's last-known position using data from dead-reckon-

ing sensors, which monitor distance and direction traveled over the ground either by images taken from a downward-pointing video camera or more simply from a compass and a pedometer that counts the number of strides the user is taking.

The researchers are also testing the best way to communicate information to the user. How much information is appropriate, and how much will confuse users? At what volumes and frequencies



As Golledge maneuvered along the route, the computer on his back crunched all those data—position, map location, and orientation—and fashioned a virtual sound display of what lay around him in which buildings and trees and lampposts would actually speak. For example, as he passed the library, he could hear the word "library" spoken to him through the headphones from the actual direction in which the building lay and in a volume that rose or fell as he



will the acoustic display interfere with sounds—like traffic noises—that blind people rely on to avoid accidents? Should the language be technical (“Look 30 degrees to the north”) or more natural (“Look to your right”)? Should it come sequentially or simultaneously? “There are hundreds of questions that we won’t have answers to until we can conduct more basic research,” says Golledge.

To avoid giving people false hopes about the near-term commercial availability of such a system, Loomis cautions that the research is a long-term project. Still, he believes the technology could be developed relatively quickly, especially if there is enough demand. “To produce something in five years may not be out of the question.”

### Near-Term Prospects

Meanwhile, a similar guidance system for the blind will get a jump on the Santa Barbara unit. Later this year, Arkenstone, a nonprofit organization based in Sunnyvale, Calif., is scheduled to introduce its Strider system, which uses some of the same tools as the Santa Barbara system, including a GPS receiver, a laptop computer, and GIS software.

The main difference with Strider is that it forgoes a virtual acoustic display in favor of a conventional speech synthesizer. James Fruchterman, president of Arkenstone, explains that his company’s goal was to introduce something quickly with proven technology. Still, he acknowledges, “virtual acoustics is worth exploring.”

Whichever technique blind users ultimately prefer, such sophisticated navigation systems may someday enable a major change in their lives. While users will still need to use a cane to avoid obstacles in their path, says Golledge, the systems confer a sense of freedom heretofore unknown. “They give you the confidence to strike off by yourself, even if you’ve never traveled the route before,” he says. “You begin to develop a feeling of independence very close to what a sighted person has.”

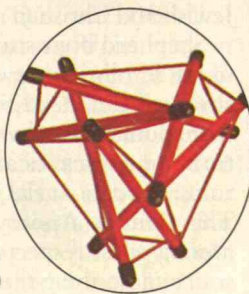
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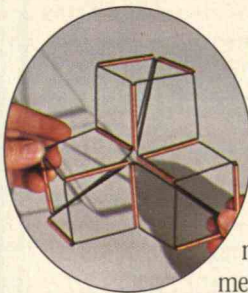
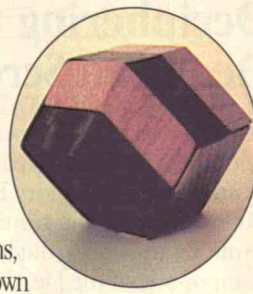
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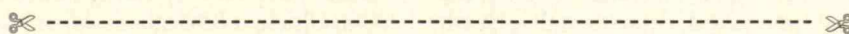


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## Deciphering the Dead Sea Scrolls

“He wrote the words of Noah.” The sentence appeared like a sign from above on Gregory Bearman’s computer screen in the summer of 1993. It came from a previously illegible fragment of one of the Dead Sea Scrolls, and it not only had Biblical scholars crying eureka, but it heralded a precise technique for ferreting out obscured and faded text on all manner of ancient media, from parchment to pottery.

It all began a year earlier, when Bearman, a physicist at the Jet Propulsion Laboratory (JPL), heard a lecture by Biblical scholar Bruce Zuckerman on the Dead Sea Scrolls and learned how much of them remained illegible. Bearman, who designs remote-sensing and imaging instruments for NASA spacecraft, is also an archeology buff with more than a passing interest in Biblical times. And, coincidentally, he was serving on a JPL committee seeking down-to-earth uses for the lab’s space technology. So he had technology transfer “on the brain,” he says.

After the lecture, he met with Zuckerman and asked if he could try to decipher the scrolls using NASA’s imaging techniques. Zuckerman eagerly agreed and helped arrange for the Getty Conservation Institute, which funds efforts to preserve early manuscripts, to loan Bearman an indecipherable piece of the Genesis Apocryphon.

Written in Aramaic, an early Semitic language, the Genesis Apocryphon is a popular retelling of the book of Genesis. Like most of the other Dead Sea Scrolls, it dates from the very dawn of the Christian era, between 100 B.C. and 100 A.D., and could shed invaluable light on the relationship between early

Jewish and Christian religious traditions.

Shepherd boys stumbled on the first of the scrolls in a cave near the western shore of the Dead Sea in 1947; since then, numerous other manuscripts have turned up in caves and archaeological ruins throughout the Judean wilderness. The Genesis Apocryphon is notable, among other respects, as the only early source describing the practice of laying hands on the sick and now, possibly, of a hitherto unknown work of Noah.



“It’s an astounding line,” says Eugene Ulrich of the sentence Bearman brought forth. Ulrich, a Biblical scholar at Notre Dame University, has spent years studying the Genesis Apocryphon. “Here we could have the title of a work by Noah,” he says, as the line was a common way of introducing an author’s work. “Or it could be an introduction to a work in the words of Noah,” he says. “It’s very exciting.”

The apocryphon is also notable for being the most deteriorated of the scrolls. In places, the black ink has eaten right through the papyrus; in others, “it looks like somebody poured blackstrap molasses over the scroll and put it in the oven for an hour,” says Sheila Spiro, executive director of the Ancient Biblical Manuscript Center in Claremont, Calif., which assists scholars studying the scrolls and other early texts. It was precisely this black-on-black parchment that Bearman wanted to try to penetrate

using the technology at the heart of his remote-sensing equipment, image spectrometry.

Also known as multispectral imaging, the technique takes advantage of the fact that all objects reflect light at different wavelengths, or spectra. With the help of computers, even the minutest differences in spectral “signatures” can be defined, just as fingerprints can be used to identify individuals. Black ink

may have a spectrum of 950 nanometers, for instance, while that of blackened parchment

may be 960 nanometers. “You look at it with your eye and you can’t see a thing,” says Bearman. But by assigning false colors to elements reflecting slightly different wavelengths of light, a computer can make those elements—including previously hidden text—stand out boldly.

Image spectrometry was originally developed to make things stand out from afar. The Airborne Visible Infrared Imaging Spectrometer, for example, is used aboard aircraft to help geologists define the composition of the ground surface below. At JPL, Bearman designs compact image spectrometers that can describe the morphology of a planet’s surface from an orbiting spacecraft.

To test the Getty-supplied fragment, Bearman “bootstrapped and cobbled together” some of his JPL equipment. But not long after he announced his discovery of Noah’s words in 1993, the directors of Shrine of the Book, the section of the Israel Museum that houses the Dead Sea Scrolls, invited him to Jerusalem to try his technique on the entire Genesis Apocryphon. Funded by JPL, Bearman, joined by Spiro and Zuckerman, went to Israel last summer, bringing with him a system that was, he says, “orders of magnitude better” than the previous one.

The new system, which could serve as the prototype of a commercially avail-



able setup, includes several pieces of specialized equipment that work with the image spectrometer. The first is a liquid-crystal tunable filter developed by Massachusetts-based Cambridge Research and Instrumentation as part of NASA's Small Business Innovative Research Program. Attached to the spectrometer, the filter allows for rapid switching between wavelengths. It enabled Bearman to study sections of the document in small increments of 10 nanometers until he found the wavelength that brought hidden text to the fore. The next addition was a digital camera, whose photos could be fed into a computer system and further sharpened and enhanced with image-processing software.

### Analyzing Artifacts

Bearman repeatedly proved the value of his equipment on his month-long trip. In one instance, he vindicated Ulrich concerning a fragment of a manuscript by Joshua found in Qumran, the cave where the apocryphon was discovered. "The fragment concerns the building of the first altar in the Promised Land, so it's not insignificant," notes Ulrich. Scholars had long believed the fragment belonged in Chapter 8 of the apocryphon, but Ulrich thought it fit—both ideologically and physically—with another fragment in Chapter 4. Indeed, he published his theory to try to set the historical record straight in a new book, *New Qumran Texts and Studies*, which, ironically, appeared just as Bearman's team began its work.

By physically bringing digitized images of the two fragments together on the screen, Bearman proved the two fragments originally were one. "It was like a jigsaw puzzle," recalls a relieved Ulrich. "They fit perfectly."

Such a finding may prove to be only the tip of the iceberg. In three decades of concentrated study, mostly using photographs of the scrolls taken in the 1950s, the Genesis Apocryphon had grudgingly revealed about 1,000 words. By extrapolation from the work Bearman's team did on just one portion of

the scroll, Elisha Qimron, a Biblical scholar at Ben-Gurion University in Beersheba who has pored over the apocryphon for decades, estimates the spectrometry technique could possibly reveal another 200 words. Since some portions are simply missing, the scroll will never be published in its original entirety. But Bearman's space-age technology could allow it to be published in as complete a form as possible.

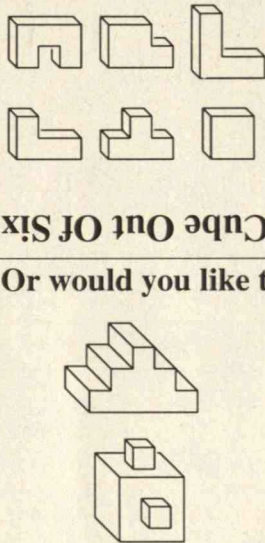
As Bearman returned home, he regretted that his work in the Holy Land had only scratched the surface. For example, he had just begun to employ spectral imaging to decipher the faded inscriptions on ancient pottery. "People kept showing up at our apartment asking if we could use our equipment to read shards of pottery, or ostraca," he says. Ostraca were used in ancient times for everything from voting ballots to bills of sale.

Because of their durability, ostraca are perhaps the best examples of early Semitic writing, Bearman points out. But many ostraca from the region bear faded red ink on a reddish clay that the naked eye cannot distinguish. Though Bearman tested only a few samples to prove the effectiveness of spectral image analysis before he left Jerusalem, his technique easily revealed the hidden words.

Bearman would like to see the equipment become a standard tool for deciphering ancient artifacts of all sorts. And, he says, JPL is committed to commercializing the technology. But the main deterrent is cost; in its current form, Bearman's system costs about \$75,000. Unfortunately, he notes, "the humanities are a cash-poor kind of business."

If institutions like the Israel Antiquities Authority and California's Ancient Biblical Manuscript Center can get sufficient funding, they could purchase the necessary components (all of which are available commercially) to build their own version of Bearman's system. His brush with antiquity is history, however. He is now back at JPL fashioning instruments for the study of an altogether different kind of darkened surface, that of the planet Pluto. —PETER TYSON

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BY BRUCE D. BERKOWITZ

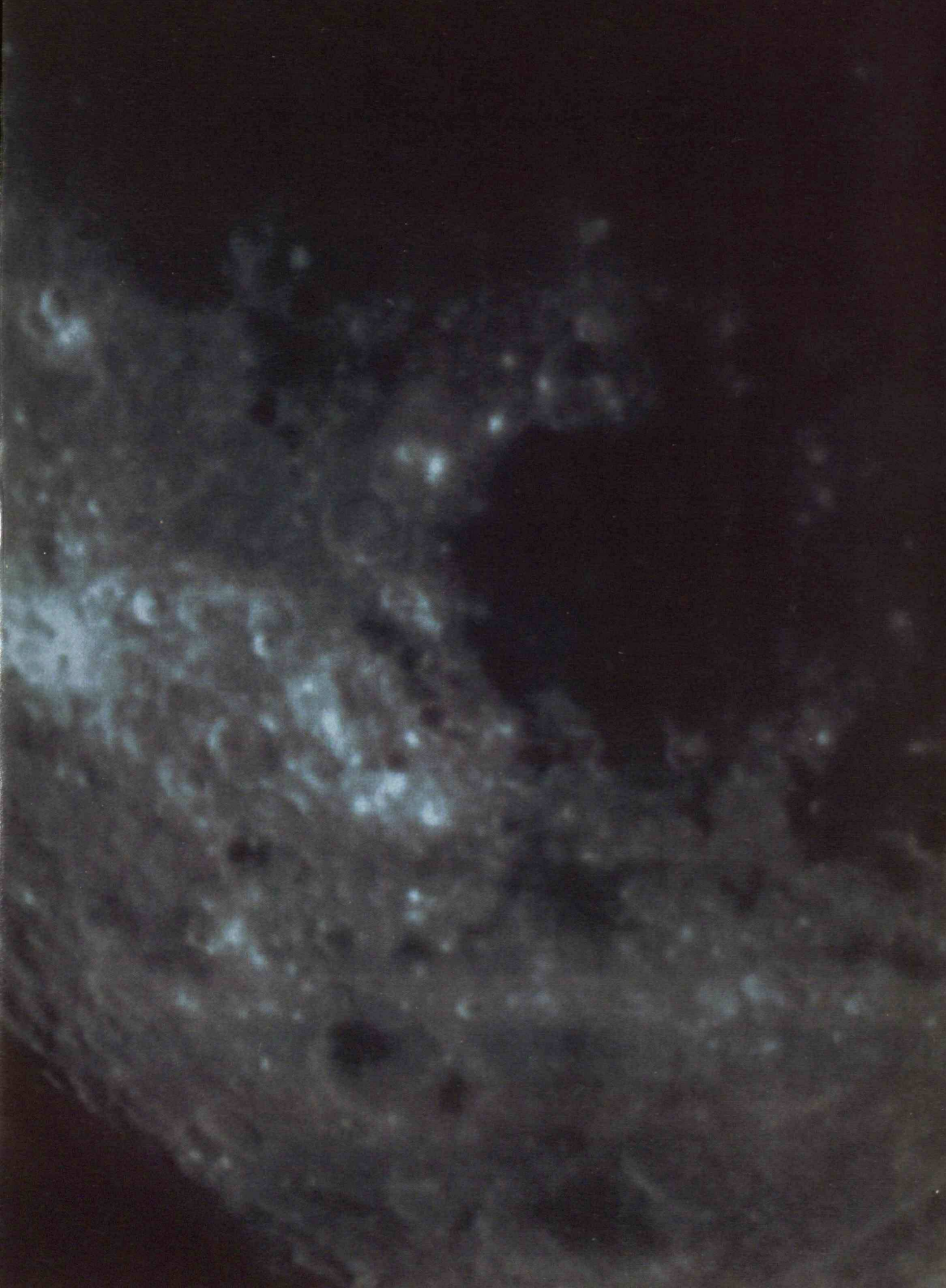
# More MOON PROBE *For Your Money*

*Clementine, the DOD project that produced such stunning images of the moon last year cost a fraction of what similar missions do, and the reason lies less with rocket science than with program management.*

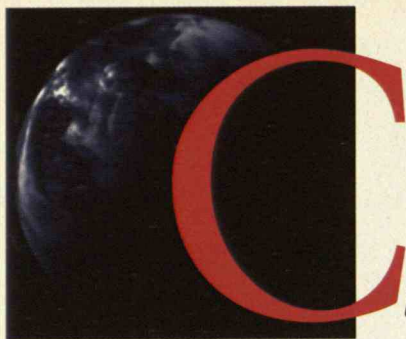
*NASA would do well to take note.*

Even the space junkies who populate e-mail bulletin boards were taken by surprise when the press reported last year that *Clementine*, an unheralded U.S. space probe, was in orbit around the moon. A small craft weighing 424 kilograms, *Clementine* was equipped with four cameras operating at different wavelengths and levels of resolution, a laser radar mapping system, and several smaller experiments designed to measure radiation and debris in space. It had been launched from Vandenberg Air Force Base in California on January 25 and had remained in low earth orbit until February 3, when ground control fired its main motor to boost it into two successive orbits of increasing size.









# Clementine reached the orbital path of the moon on February 19 and fired its second motor to enter lunar orbit, where it spent six

weeks surveying the moon's surface.

The resulting images, run by newspapers like the *New York Times* and the *Washington Post*, included perspectives rarely seen before, such as a view of the moon from above its south pole. Some analysts believe *Clementine's* imagery suggests that ice may exist in some of the shaded valleys and craters near the poles; such water sources, if confirmed, could support permanent lunar bases, which might be used to exploit the moon for mining operations. The bases could also make the moon a jumping-off point for other missions to explore the solar system.

But *Clementine* was notable for other reasons as well. For one thing, it was planned, built, and launched in two years, less than half the time required for most space probes. And then there was the cost: just \$80 million for the spacecraft, launch, and operations—about a quarter of what the least expensive NASA interplanetary missions cost. Indeed, *Clementine* bucked a 20-year trend in which scientific spacecraft had become ever more expensive. For example, the *Mariner 5* and *Mariner 6* probes to Mars, built as a pair and launched in 1969, cost \$260 million in inflation-adjusted 1994 dollars, while the *Voyager 1* and *Voyager 2* interplanetary probes, built and launched in 1977, cost about \$350 million each, and the *Galileo* Jupiter probe, launched in 1989, cost about \$1.1 billion.

The truth is that *Clementine* was able to make it to the moon cheaply for much the same reason it was able to do so unnoticed: the mission was not a project of NASA, which sponsors most U.S. scientific space missions. Instead, the spacecraft was built by the Naval Research Laboratory (NRL) and funded by the Ballistic Missile Defense Organization (BMDO)—formerly the Strategic Defense Initiative Organization and better known as the agency behind Star Wars. The story of how these two groups came by the opportunity to build a space probe in the first place suggests not only effi-

cient, lost-cost approaches to engineering and technology but also organizational changes that would make these approaches more feasible.

## Breaking the Mold

The Naval Research Laboratory's space operations, though not widely known, began immediately after World War II and evolved through the 1950s into *Vanguard*, the first U.S. satellite program. At the time, virtually all expertise in building rockets resided with the military, so it was natural for a defense lab to conduct space research. It was not until May 1959, when President Eisenhower decided to put space exploration under civilian control, that most of the *Vanguard* team moved to form NASA's Goddard Space Center.

What was left became the Naval Center for Space Technology (NCST), a small organization within NRL that designs prototype space systems, often classified, for the Navy and other branches of the Department of Defense. Including *Clementine*, the center has built 83 spacecraft since 1960, or better than two per year. The best-known recent NRL space project is the satellite-based Global Positioning System; this was the system that U.S. troops relied on in the Gulf War to navigate on the featureless desert. It is now being used to aid most forms of commercial transportation.

NRL began to build satellite test platforms for BMDO in the mid-1980s, following the *Challenger* tragedy. NASA had grounded the shuttle for two years to correct safety hazards and then moved high-priority payloads such as intelligence satellites and the Hubble Space Telescope up in the launch queue. BMDO, which had had several of its experiments bumped, hired NRL to design a spacecraft that could carry these experiments and be launched on an expendable booster; this became the 1990 LACE satellite, which carried several demonstrations of missile defense technology, including a laser-aiming experiment and a prototype of an electro-optical sensor for identifying the exhaust plumes of rockets from space.

The success of LACE led to further collaboration. One key BMDO project was to go into deep space to

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Clementine Mission  
Uncontrolled Image Mosaic  
Lunar South Polar Region  
Orthographic Projection

SOME OF THE  
IMAGES FROM  
CLEMENTINE  
SHOW PER-  
SPECTIVES  
RARELY SEEN  
BEFORE, IN-  
CLUDING A VIEW  
FROM ABOVE  
THE MOON'S  
SOUTH POLE.

test new sensors for tracking “cold objects” such as warheads or satellites that, unlike rockets and missiles, lack a bright, easily detected exhaust plume. Since arms control agreements prevent BMDO from testing missile defense components in space against actual missiles, it decided instead to analyze and track natural objects—in this case the moon and Geographos, an asteroid due to pass near earth. The result was *Clementine*, a probe that would venture into deep space and, like its namesake, be “lost and gone forever.”

*Clementine*, in other words, became a space probe largely by happenstance. Still, the basic ingredients that made it a low-cost mission are straightforward—at least in retrospect. They include:

**BUILD TO BUDGET.** Probably the most important reason why *Clementine* cost \$80 million was that that was the amount of money BMDO determined it could afford. Since science was actually a secondary goal for the mission, BMDO and NRL intentionally set their sights on a spacecraft of limited size and cost and quickly discarded “neat ideas” that were too expensive.

**BUILD TO SCHEDULE.** The price of a mission is directly linked to the time it takes to carry it out, since main-

taining staff, facilities, and other overhead is costly. BMDO selected Geographos as a target in part to force a tight schedule; this contained costs. NASA, in contrast, usually allows greater margin for schedule slips when designing its own missions. This does reduce the risk of missing an opportunity to observe a scientifically important phenomenon, but it also permits costs to rise. For example, delays and modifications in the *Galileo* program added about \$520 million to the mission.

**USE NEW TECHNOLOGY WHEN COST-EFFECTIVE; AVOID IT WHEN NOT NECESSARY.** The *Clementine* project took advantage of new, lightweight sensors and solar panels to cut the size and mass of the spacecraft. This allowed the *Clementine* team to use a smaller, less expensive launch vehicle. Space probes like *Voyager* or *Mars Observer* require a large launch vehicle such as the Titan 3 or Titan 4, which costs approximately \$200 million to \$300 million; *Clementine* was able to use a Titan 2, which cost only about \$20 million.

Yet avoiding new technology where it was not essential was just as important. Most of the spacecraft was based on off-the-shelf hardware and NRL's previous

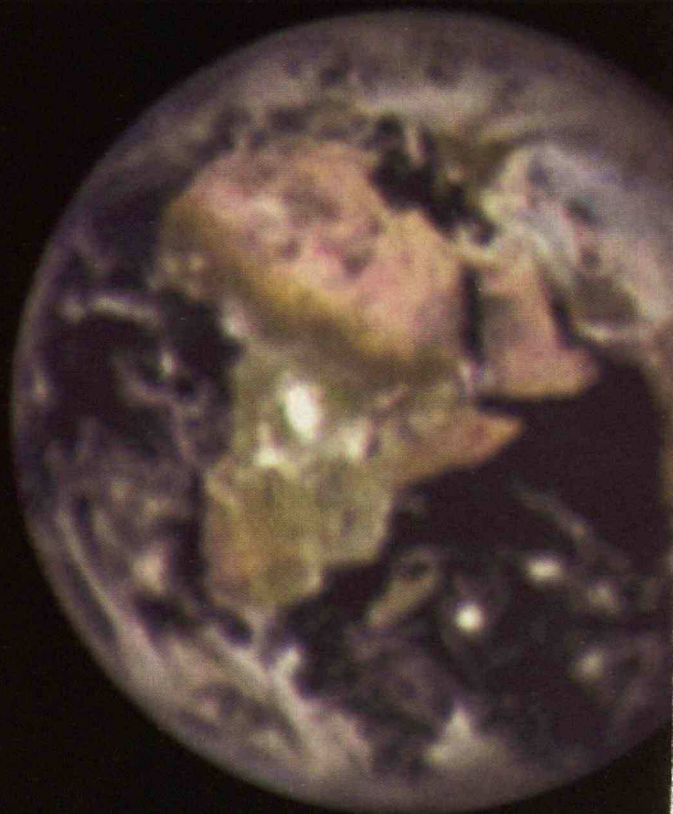


ALTHOUGH *CLEMENTINE* (INSET) WAS SMALL AS SPACE PROBES GO, WEIGHING ONLY 424 KILOGRAMS, IT WAS EQUIPPED WITH FOUR CAMERAS OPERATING AT DIFFERENT WAVELENGTHS.

THE "ULTRAVIOLET/VISIBLE" CAMERA

WAS RESPONSIBLE FOR THIS VIEW OF THE AFRICAN CONTINENT (NEAR RIGHT), AND ALL FOUR CAMERAS HELPED IMPROVE SCIENTISTS' UNDERSTANDING OF THE LUNAR NORTH POLE (FOUR IMAGES,

FAR RIGHT). UNTIL THE *CLEMENTINE* MISSION, THE 1985 U.S. GEOLOGICAL SURVEY MAP IN THE UPPER LEFT CORNER WAS STATE OF THE ART.



spacecraft designs. This further reduced the mission's costs.

**LEARN TO LIVE WITH IMPERFECT RELIABILITY.** The first rule of space operation is (or ought to be) that some failures are inevitable. If a spacecraft consists of 10,000 major components, a reliability level of 99.9 percent will still result in 10 components that malfunction. Trying to eliminate the probability of a failure drives costs up exponentially, and this is one reason why space programs have been caught in a vicious circle: designers demand high reliability, which increases the cost of the vehicle, which then leads to greater demands for reliability.

The *Clementine* program took a different approach. First, the spacecraft and mission plan were designed with enough tolerance to accommodate the inevitable glitches. Second, by limiting the overall cost of the mission, even a total failure would not have been a disaster.

Indeed, some glitches did occur. When ground controllers were preparing to move the spacecraft out of earth orbit and send it to the moon, software crashed repeatedly. But because *Clementine* was designed to reach the moon in increments, controllers were able simply to leave the spacecraft in earth orbit for several days while the engineers developed and tested various fixes.

Later, the spacecraft suffered a catastrophic failure. A software error caused a thruster to fire continuously, putting the probe into an uncontrollable spin and preventing it from carrying out the final phase of the mis-

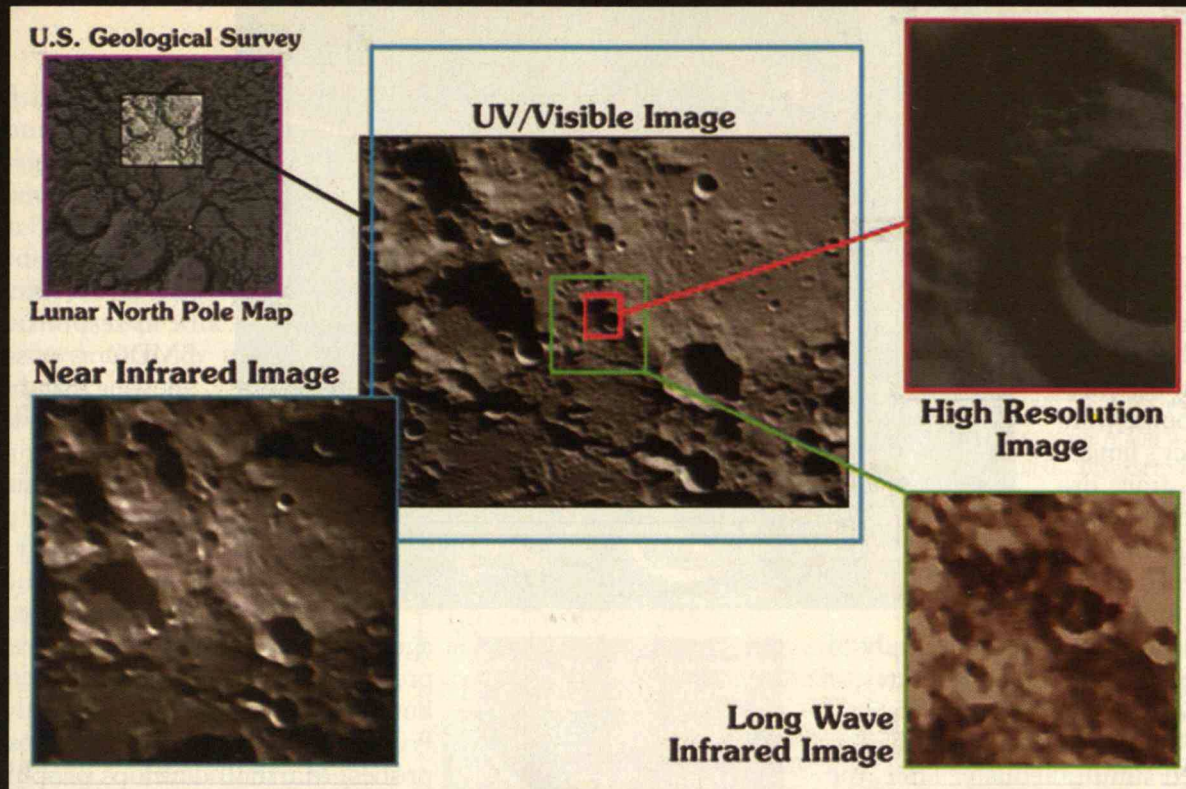
sion—that of tracking and producing images of Geographos. Fortunately, by that time *Clementine*, in mapping the moon, had achieved 90 percent of its scientific objectives. But even if the failure had occurred at the very beginning of the mission, \$80 million failures are generally better than \$500 million failures. And failures will happen no matter what.

**MAINTAIN A SMALL STAFF AND A FLAT MANAGEMENT STRUCTURE.** NCST is a fraction of the size of the typical NASA space center, and this smaller staff reflects a less complex, more efficient management style. All the steps in building *Clementine*—design, construction, testing—were carried out under the same roof, and most of the team worked in a single building within shouting distance of one another every day. NASA, on the other hand, is bureaucratically baroque, full of nooks and crannies harboring officials who must say yes and can often say no.

And while a typical NASA ground control center occupies a large building and requires several dozen people, the *Clementine* ground station fit into a small room. NCST also used the same personnel for operations as it did for building and testing the spacecraft, thus reducing total personnel requirements and training costs.

**ADOPT AN AUSTERITY MINDSET.** NRL builds spacecraft in a 50-year-old hangar-like building that was collapsing on itself until a steel framework was built around it a





few years ago. Similarly, the *Clementine* ground station was an old warehouse in nearby Alexandria, Va.

Such facilities cost less, of course, but there is something more important at work. Many government programs famous for efficiency and effectiveness have operated out of less-than-glamorous quarters; the Polaris submarine program comes to mind, as does NASA itself in the 1950s and 1960s. NRL's austerity seems to reflect a no-nonsense mindset as much as a concern with budgets.

### Inefficient to the Core

NASA administrator Daniel Goldin is already attempting to emulate *Clementine*. One of his showpieces is the Small Satellite Technology Initiative (SSTI), a program announced in February 1994 that, on paper, looks like *Clementine* with a NASA logo. SSTI is intended to demonstrate spacecraft technology and, along the way, collect scientific data at low cost. The two SSTI spacecraft—dubbed *Lewis* and *Clark*—will cost about \$50 million (not including launch) and be built on a tight, two-year schedule. SSTI has also shown that NASA can, when it wants, push paper quickly. The entire process of sorting through competing designs and negotiating a contract took less than three months.

But alas, SSTI—and a handful of other showcase programs such as the *Discovery* series of scientific probes and the *Small Explorer* satellite program—account for

only a small portion of NASA's activities: *Lewis* and *Clark* together draw less than 0.6 percent of the agency's \$14 billion budget for 1995. In effect, innovative programs such as SSTI are being laid on top of NASA's massive infrastructure and traditional core activities, such as the shuttle and the space station. And although Goldin is trying to scale down these core activities and make them more efficient, the way NASA is organized and operates raises serious questions about whether he will be able to pull it off.

One of NASA's institutional problems is that it lacks an effective process for establishing goals and identifying the best compromise among costs, risks, and payoffs. When the agency has defined goals for itself in the past, those goals—such as “maintaining U.S. leadership in space sciences”—have often been so broad that any pet program within the agency could be said to support them. Alternatively, the goals have been so narrow—“maintaining a manned presence in space” is one example—that they were an obvious attempt to protect a particular program like the shuttle or space station.

A more effective approach would be to define a comprehensive list of research goals that are reasonably specific but that do not dictate a single solution. NASA might, for instance, resolve to develop a reliable worldwide climate model, or promote technologies that would reduce launch costs. The objective should be to permit the research community to propose a variety of

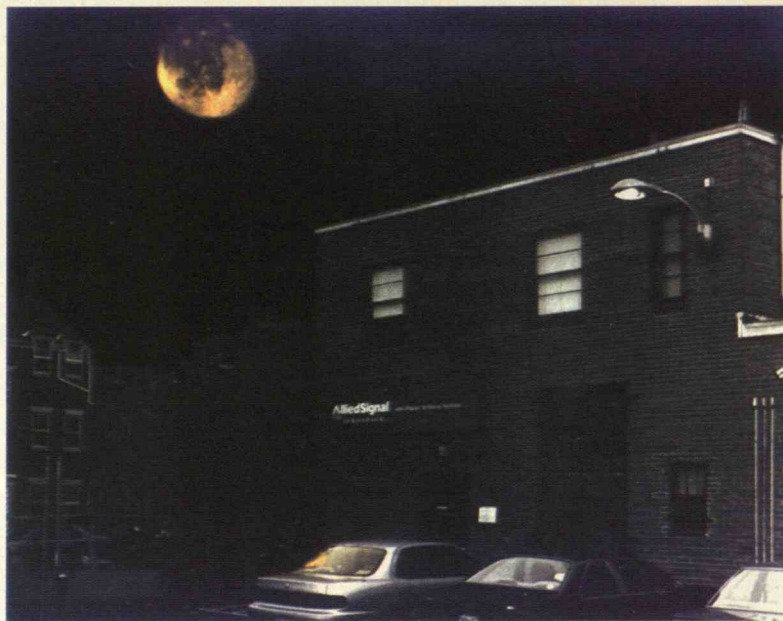


strategies to achieve each goal, and then evaluate each strategy in terms of cost, risks, and payoffs.

This approach would force NASA to develop programs that, while not ideal solutions, represent the most effective compromise within the agency's limited budget—a trait distinctly lacking in many NASA programs. For instance, when NASA began planning the Earth Observation System, a family of environmental monitoring satellites, it essentially decided that all environmental data were valuable, and that all had to be collected simultaneously. Thus, the only option was to build two very large satellites equipped with state-of-the-art sensors. Not until Congress balked at the price and the risk of putting such a large investment on a single platform did NASA consider building several smaller satellites that could achieve its goals incrementally.

Similarly, much of the high cost of the Hubble Space Telescope resulted from trying to achieve very ambitious goals while using the limited data-processing technology that was available in the 1970s, when the basic design of the spacecraft was frozen. The cost of the program could have been reduced significantly if NASA had seriously analyzed tradeoffs and deferred some research goals just a few years. After all, trends in data-processing technology were reasonably clear, and officials surely must have known that computers would soon become much less expensive. But there simply was no effective process for determining which goals could be achieved easily with mature technology and which might better be put off.

Once NASA has established a comprehensive set of research objectives, it could address a second institutional problem, which is that because it is both a funding agency and an operating agency, it unnecessarily restricts the sources of ideas for space-related research. *Clementine* was cost-effective partly because BMDO, which held the dollars and was the party that would use the data from the mission, had the prerogative to



FACILITIES FOR  
THE *CLEMENTINE*  
MISSION WERE  
MODEST, REFLECT-  
ING A NO-NON-  
SENSE MINDSET.  
THE GROUND STA-  
TION, NICKNAMED  
THE BAT CAVE,  
WAS AN OLD  
WAREHOUSE IN  
ALEXANDRIA, VA.

shop around for a spacecraft and an incentive to get the most for its money. As the "seller" of the system, NRL, in turn, had an incentive to be as responsive to BMDO as possible, knowing that the latter could look for another supplier or forgo the mission completely.

NASA usually does not enjoy such a market. True, the

agency does have some ability to select proposals from competing field centers, but each center has its own turf: the Jet Propulsion Laboratory builds most space probes, Marshall develops propulsion systems, Goddard develops earth-orbiting satellites, and so on. And although a few programs such as Discoverer have benefited from a decision to allow other government agencies, contractors, and academic institutions to submit proposals, these programs, like SSTI, account for a minuscule portion of the NASA budget.

It is worth noting that NASA's Ames, Lewis, and Langley research centers were all established before the agency even existed, and that Goddard, Marshall, and the Jet Propulsion Laboratory were built up around DOD research organizations transferred to NASA. Thus, the

claim these centers have to space science funds derives mostly from the historical accident of coming under the NASA umbrella. The unfortunate implication is that NRL—or any other research center, such as AT&T's Bell Labs or one of the national labs run by the Department of Energy—could come up with the most promising idea for a space research project and be unable to carry it out.

### Top-to-Bottom Reform

Goldin has tried to wrestle NASA into a more efficient mode of operation program by program. But he has to contend with inertia and politics. He has inherited large, expensive programs such as *Casini*, the \$1.3 billion probe scheduled to explore Saturn in 1996. And even if



he wanted to cancel the white elephant that is cleverly disguised in the NASA budget as a space station, President Clinton's need to carry California in the 1996 election and the administration's efforts to integrate Russian technology into the project so as to provide that country with hard currency make this a non-starter.

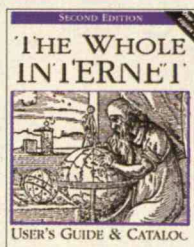
Also, Goldin lacks full control over his agency. Not only is there bureaucratic pressure for NASA to fund programs at NASA centers, but much of the administrator's influence is limited to his ability to say no. Most NASA programs are proposed, developed, and implemented by the managers and engineers at the various centers.

Nor will Goldin receive much help from the several studies that have been conducted in recent years to determine how to make NASA more efficient. Most, such as the 1990 report by the Augustine Commission and the 1989 study by the National Academy of Public Administration, have focused on details such as streamlining the contracting process. None have examined the basic organizational structure that determines what programs NASA decides to undertake and who carries them out.

The best way to approach the task of reforming NASA is to forget about "fixing" the organization and start considering an all-out change in how the United States funds and conducts space research. The most important objective is to break up the bureaucratic obstacles that have thwarted even the best-intentioned reformers. Let NASA do what NASA has done best—serve as a conduit for money—and open up the field to competition from government labs, universities, the private sector, and anyone else who might happen to have a better idea about how to explore the heavens. ■

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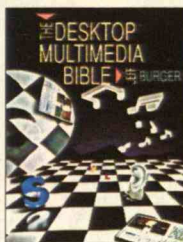
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# HACKERS

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**ILLUSTRATIONS  
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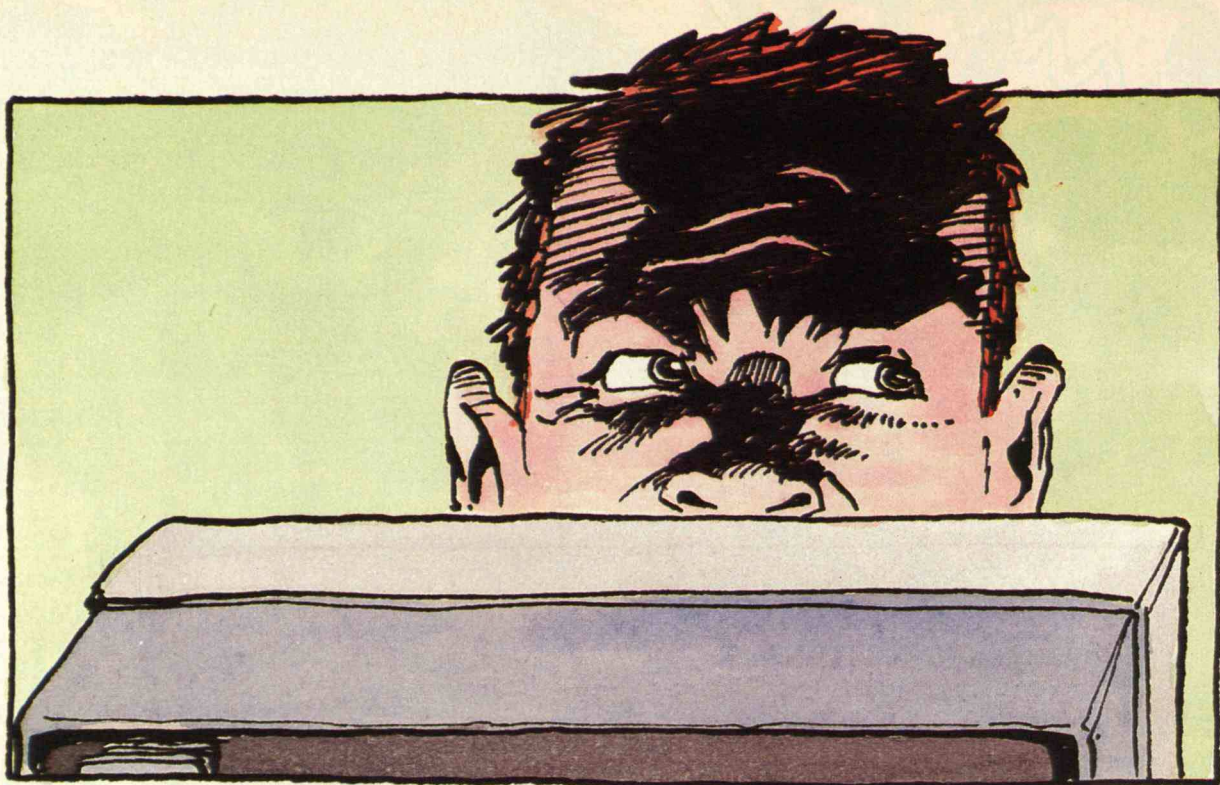


**I**n the early 1980s, researchers at MIT's Architecture Machine Group—forerunner to the present-day Media Lab—devised an elegant way to discourage potential mischief makers from crashing the group's computer system. Any user, from an undergraduate assistant to the most senior scientist, could erase other researchers' files simply by typing the command "crash." The method was so obvious that it took all the fun out of hacking the system, and it worked. Causing a shutdown was a challenge unworthy of a true hacker's skills, so no one even bothered to try. ★ The scheme's effectiveness, of course, rested on the fact that the group was a closed community with "a certain amount of trust between members," says Simson Garfinkel, a computer security expert and journalist who was a student in the group at the time. This ap-

*Former interlopers who carry the torch of respect for computers and the information they contain have been helping foil the minority of truly dangerous criminals.*

**BY WADE ROUSH**





proach, he notes, “doesn’t work if there are people on the outside who can get in.”

In the present networked era, when a computer system’s “outside” includes virtually anyone with a PC and a modem, trust would indeed seem to be a thing of the distant past. Well-publicized episodes, like the 1986 infiltration of U.S. government computers by a group of KGB-employed West German hackers and the 1988 Internet worm (a self-replicating program that clogged academic computer systems across the nation), have taught system administrators the importance of protecting users’ passwords and trying to eliminate possible “back doors” into their systems. Nervous about exposing themselves to roving data thieves, many corporations are refusing to join their local networks to the Internet, while others are spending millions installing “firewalls”—gatekeeping computers that filter out all but a few authorized forms of data exchange. And needless to say, at today’s Media Lab and most other research centers, access to commands that affect other users’ accounts is closely guarded.

Partly because of such improved security measures as well as the threat of imprisonment, most of the elite young hackers whose clubs became media staples during the 1980s—the 414 Gang, Legion of Doom, Masters of Deception—have matured, gotten jobs, or been

scared off. But a few of their number have gone even deeper underground, selling their skills as high-tech bandits in the age-old trade in secret information.

“The days of playful hacking, when any teenager with a modem could access a bank’s UNIX machine, are gone forever,” says Forkboy, a 21-year-old desktop publishing expert in Cleveland. As a teenager, Forkboy hacked his way into computers owned by universities, credit agencies, and long-distance phone companies (like most of the hackers and former hackers interviewed for this article, he asked not to be quoted except under his “handle”). But while this kind of hacking has become less common, “cracking”—programmers’ jargon for malicious computer meddling—is on the rise.

Under these conditions, a circumscribed kind of cooperation between information security managers and hackers who eschew theft, revenge, and other clearly criminal motives is starting to take shape.

### Hacking’s Brief Heyday

In its original technological sense, the word “hacker,” coined at MIT in the 1960s, simply connoted a computer virtuoso. That’s still the meaning enshrined in the 1994 edition of the *New Hacker’s Dictionary*, which defines such a person as someone “who enjoys exploring the details of programmable systems and how to stretch their capabilities; one who programs enthusiastically, even obsessively.”

But beginning in the 1970s, almost as soon as there were such things as modems and computer networks,

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"hackers" also came to describe people who hungered to know off-limits details about big computer systems—and who were willing to use devious and even illegal means to satisfy this curiosity. Penetrating corporate and academic computer systems required not just technical aptitude but also the social skills necessary to sweet-talk office workers out of their computer passwords, the persistence to spend hours "dumpster diving" in search of proprietary computer manuals and other crucial scraps of inside information, and a streak of rebellious, macho nihilism. Thus endowed, hackers set out to see how far down the Establishment's electronic corridors they could creep before anyone would take notice.

At first, it was pretty far. "When I started out, most 'sysadmins' [system administrators] were not even aware of hackers," Forkboy recalls. "They were utterly clueless about security. The companies selling operating-system software told them 'Don't worry, you're fine,' and they believed it." Breaking into a system was often as easy as guessing someone's poorly chosen password, then exploiting known bugs in common mailing or editing programs to relabel computer files or transfer their ownership, thereby gaining "superuser" status. Hackers could rewrite system software, create dummy accounts, and leave behind "logic bombs" or "Trojan horses," hidden programs designed to execute automatically under certain conditions or to allow access to the system later.


As illicit as it was, hacking was rarely a lone pursuit. In the hacker "crews" of major urban centers, in endless conference calls pirated from long-distance companies by "phone phreaks," and on dozens of underground electronic bulletin-board systems, hobbyists shared war stories and exchanged information about the latest security holes.

The common badge among these young computer outlaws was a sense of superiority to the bureaucrats whose systems they could so easily infiltrate. "All of my close hacker friends have nil respect for 'the Man,'" says Quinn, a 23-year-old West Virginian who was arrested five years ago for dialing into a local power-company computer. It wasn't the content of such institutions' files so much as the thrill of unearthing them that fired hackers' ambitions, earning them, in Quinn's words, "warrior's stripes, another skull on their belt."

Yet many hackers, sensing the chaos their intrusions could cause, also set strict personal limits for their on-line adventures. Forkboy says he never stole tangible goods or money and that he viewed acquaintances who did with "disapproving apathy." Julia, a Boston teenager, says she stopped hacking more than a year ago because "I was so nervous that I would do something bad to a system and really screw it up by mistake. People who go and delete entire files so that they completely collapse the system are not respected at all in the hacker community."

At least one hacker, the Knightmare, a 22-year-old software developer, is using the printed word to spread an ethic of more mature, "responsible" hacking. In his recent book, *Secrets of a Super Hacker*, which has sold over 40,000 copies (including many to computer-crime squads across the nation), he shares his "set of ideals":

- Never harm, alter, or damage any computer, software, system, or person in any way.
- If damage has been done, do what is necessary to correct that damage, and to prevent it from occurring in the future.
- Do not let yourself or others profit unfairly from a hack.
- Inform computer managers about lapses in their security.



*Law-enforcement  
crackdowns had a chilling  
effect on the hacker community:  
"We all got pretty paranoid  
after that."*

- Teach when you are asked to teach, share when you have knowledge to spread. This isn't necessary, it is politeness.
- Be aware of your potential vulnerability in all computing environments, including the secret ones you will enter as a hacker. Act discreetly.
- Persevere but don't be stupid and don't take greedy risks.

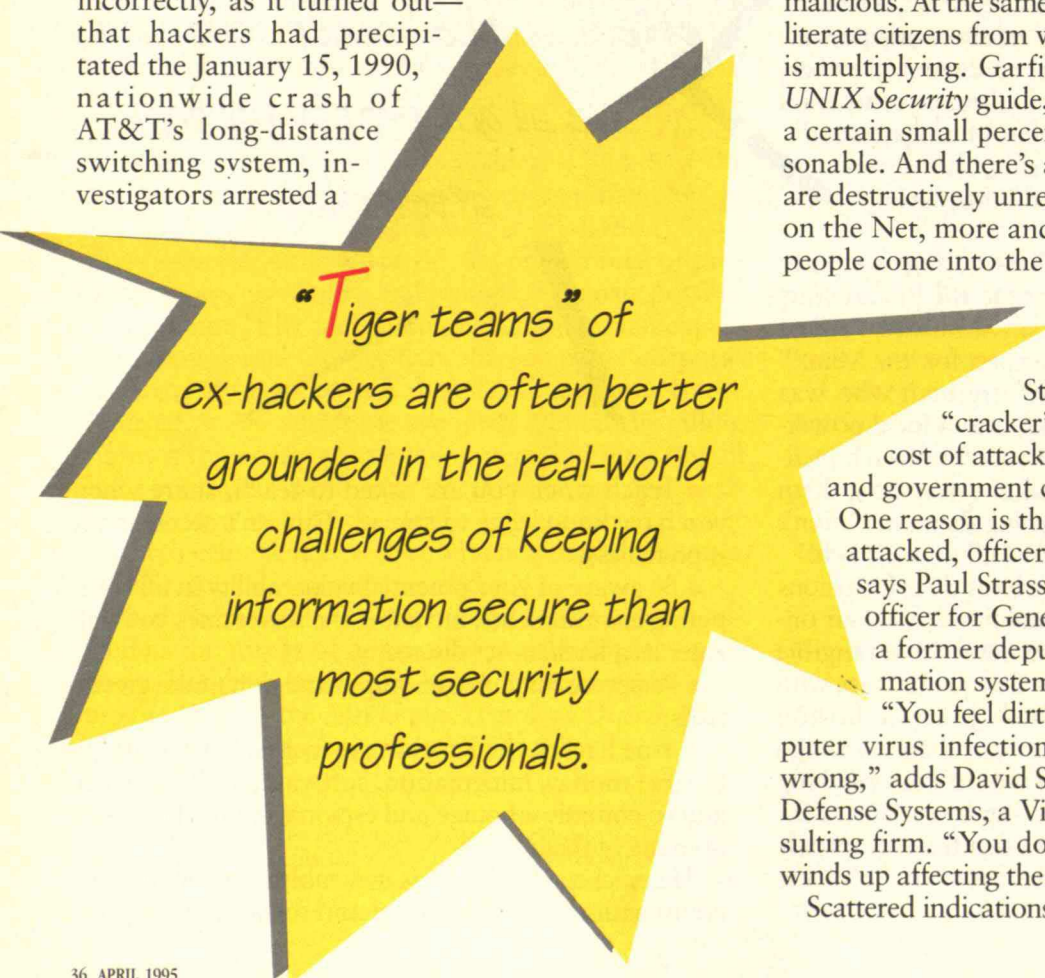
A true hacker, the Knightmare insists, has the ability to steal money, information, software, and hardware and to commit sabotage and espionage, but chooses to do none of these things.

The hackers' heyday was inevitably brief, ended by a combination of technological and social changes. One



was the growth of the Internet and electronic mail as means of communication. "The development of networking was a big blow to hackers, because it meant that if two or three sysadmins found out about an operating-system hole or a common system weakness, pretty soon everyone who cared knew about it and plugged it," Forkboy explains. The explosion in access also filled the formerly elite hangouts, like private bulletin-board systems, Internet Relay Chat (a live online communication system), and Usenet newsgroups, with naive hacker-wannabes. "The culture began to die out when it got popular, when you could read about it in magazines, when they started holding hacker conferences at huge hotels," says a disillusioned Asrock, a 22-year-old former hacker who was arrested in 1987 for hijacking sections of a corporate voice-mail system for use by other hackers and who now works as a software engineer at a Boston-area technology firm. The hacker community, Julia summarizes, got overrun.

At the same time, law-enforcement crackdowns proved a strong deterrent to committed hackers. In 1989 and 1990 the federal Computer Fraud and Abuse Task Force, Arizona's Organized Crime and Racketeering Unit, the U.S. Secret Service, the FBI, and other agencies closed in on a small network of hackers who had circulated a purloined BellSouth technical file describing the 911 emergency telephone system. Suspecting—incorrectly, as it turned out—that hackers had precipitated the January 15, 1990, nationwide crash of AT&T's long-distance switching system, investigators arrested a



*"Tiger teams" of ex-hackers are often better grounded in the real-world challenges of keeping information secure than most security professionals.*

dozen well-known figures in the hacker underground and impounded their computers. The only trial to result from the raids, that of a St. Louis hacker-newsletter editor known as Knight Lightning, fell apart when the defense demonstrated that the information in the 911 document was publicly available through a phone-company catalog. The arrests nevertheless had a chilling effect on the hacker community. "I was still active then, and it scared the hell out of me," says Forkboy. "We all got pretty paranoid after that."

Meanwhile, the thrill of hacking was wearing off for many. The generation of hackers who began as young teenagers in the early 1980s, when the personal-computer revolution was first taking hold and the influential 1983 film *War Games* portrayed young hackers as ingenious heroes, has left high school or college and graduated to more real-life concerns. "It's just so dangerous nowadays," says Julia. "There are a lot of great former hackers out there who are married with kids and who don't have time to go to jail."

## The New Computer Intruders

But if the ranks of old-school hackers have thinned, the volume of computer intrusions has not. The departure of so many hackers from the field means that a growing proportion of computer intruders are genuinely malicious. At the same time, the population of network-literate citizens from which a criminal few may emerge is multiplying. Garfinkel, coauthor of the *Practical UNIX Security* guide, points out that "there is always a certain small percentage of people who are unreasonable. And there's an even smaller percentage who are destructively unreasonable. As more people come on the Net, more and more of these very destructive people come into the community. So even though it's a small percentage, the absolute number of malicious hackers is increasing."

Statistics on the exact size of this "cracker" population or the frequency and cost of attacks on U.S. corporate, educational, and government computers are hard to come by. One reason is that "even if a company has been attacked, officers generally won't talk about it," says Paul Strassmann, former chief information officer for General Foods, Kraft, and Xerox and a former deputy assistant secretary for information systems at the Department of Defense. "You feel dirty after a hacker attack or a computer virus infection, like you've done something wrong," adds David Stang, president of Norman Data Defense Systems, a Virginia information security consulting firm. "You don't want to tell anybody, which winds up affecting the reporting of incidents."

Scattered indications of the rise in cracker attacks are





available, however. A 1992 study by USA Research Inc., a Portland (Ore.)-based technology consulting firm, found that the number of unauthorized intrusions detected in U.S. workplace computers grew from 339,000 in 1989 to 684,000 in 1991. Intruders altered or destroyed data or software in 42 percent of the cases the company studied, at a cost of \$82 million in 1989 and \$164 million in 1991. L. Dain Gary, manager of the Pittsburgh-based Computer Emergency Response Team—formed by the Defense Advanced Research Projects Agency in 1988 to coordinate responses to crises like the Internet worm—says the team received reports of some 130 incidents in 1990, 800 in 1992, 1,300 in 1993, and 2,300 in 1994. Twenty percent of a group of 1,271 companies of various sizes surveyed in 1994 by the Cleveland consulting firm Ernst & Young reported financial losses from unauthorized computer break-ins by hackers, competitors, or employees. Also in 1994, more than a million secret passwords were intercepted by “sniffer” programs planted in computers at dozens of Internet hubs.

But as Stang points out, the difficulty of determining whether computer data have been copied or altered means that the actual number of such break-ins is likely far higher than the number detected. And since, in Strassmann’s words, “you have a big multiple of the gross national product today spinning on magnetic disks,” the actual financial stakes in computer crime are far higher than the losses so far uncovered.

The pirating of secret codes allowing access to voice-

mail services and long-distance telephone connections alone has been estimated to cost companies more than \$1 billion per year. Last October, Secret Service agents charged Ivy James Lay, an engineer at MCI Telecommunications, with intercepting 60,000 calling-card numbers over a period of several months using a sophisticated Trojan horse program planted in a phone-line switching station in Charlotte, N.C. Lay, known to some in the hacker community as Knightshadow, sold the numbers for \$3 to \$5 each, according to the Secret Service, which has jurisdiction over interstate telephone fraud. Resold to electronic bulletin-board operators around the United States and Europe, the numbers were eventually used to charge more than \$50 million in illicit long-distance service.

Incentives for computer crime are not limited to money alone, and motivations like vengeance and politics can cause far more damage. The admission last July by the Defense Information Systems Agency that crackers had penetrated “major portions” of the Pentagon’s unclassified networks, “adversely affecting” the nation’s military strength, suggests the potential for harm. Thus Strassmann, who teaches students at the National Defense University how to defend against “data warfare,” adds that “the people who are doing the attacks are not just crackers. They are information terrorists. Their purpose is to damage the economic and defensive capabilities of the United States.” In a 1994 report on global organized crime, the Center for Strategic and International Studies, an independent research center



formerly associated with Georgetown University, asserted that "a despot armed with a computer and a small squad of expert hackers can be as dangerous and disruptive as any adversary we have faced since World War II."

## The New D tente

Because computer-related crime is growing more sophisticated, more varied, and more costly to American society, information-security experts and law-enforcement agencies have begun to enlist hackers in the battle for safety and order in the digital realm. Both system administrators and hackers acknowledge that the unchecked growth of computer crime could lead to a bleak future in which the average user's access to computing resources is so tightly monitored that the freedom to explore, communicate, and innovate on the electronic frontier is sacrificed.

Many active or former interlopers, fed up with their criminal cousins for giving all hackers a bad name, are therefore applying their skills as software developers, security consultants, and pamphleteers for responsible hacking. "Computer security is a way for us to continue what we've always done in a good, safe, legal way," says Asrock.

The main obstacle to greater cooperation between the two groups, of course, is their mutual suspicion. But cultural changes under way in both camps—including growing recognition of a common enemy—are making room for a cautious truce and even an alliance of sorts.

Phillip King, president of Data Integrity Services, a Kansas City-based security consulting firm, says, "I make my living trying to stop hackers from breaking into systems, so it sounds kind of funny for me to say this, but most of them are pretty good guys." A former computer analyst with Air Force Intelligence who now advises banks, utilities, and insurance companies on how to reduce their risks from computer crime, King says his goal "is not to catch hackers and put them away. It's to understand them and to use that knowledge to stop the truly malicious vandals." The Nightmare insists that "hackers love and respect computers. They want computers to stay healthy. So it's in hackers' best

interest for the people in charge of computers to know how to maintain good security."

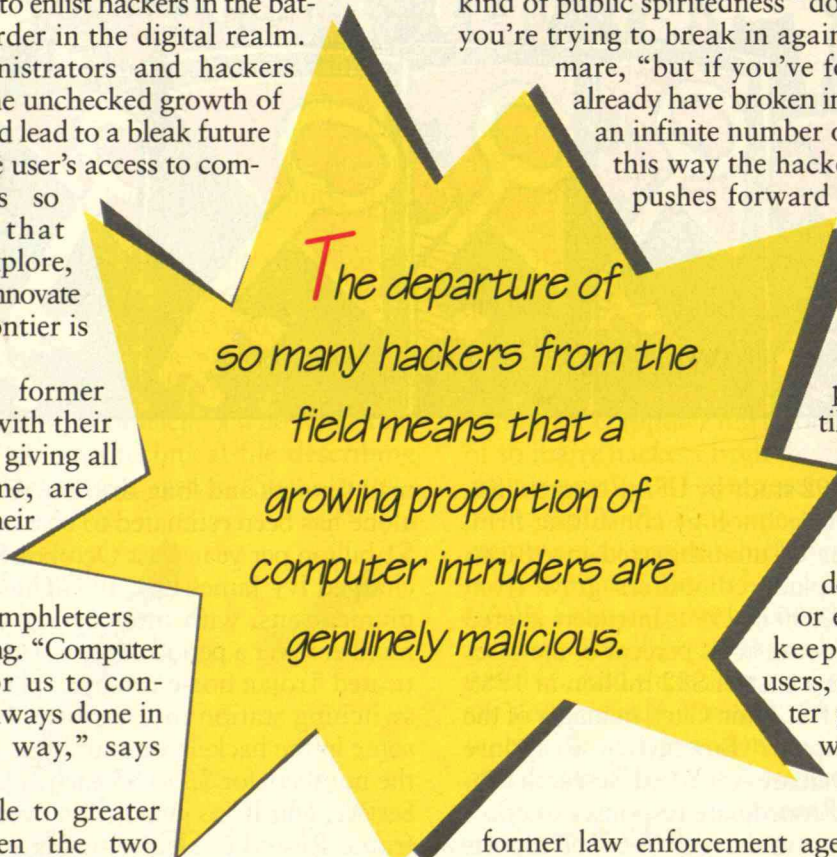
Hackers love a challenge above all else, so discovering lax security measures pains them in the same way that playing a novice at chess would exasperate a grand master. It's not uncommon, for example, for administrators arriving at work in the morning to receive e-mail from solicitous hackers who may have romped through the system the night before thanks to some previously undiscovered security hole, but who would like to ensure that the drawbridge is raised after them. This kind of public spiritedness "does work against you if you're trying to break in again," admits the Nightmare, "but if you've found a hole, then you already have broken in, and there's essentially an infinite number of systems to hack." In this way the hacker presence constantly pushes forward the

limits of computer security techniques. There can be no real test of a security system's reliability, many professionals say, until some wily hacker attempts to break it.

As members of "tiger teams" hired to test computer security or develop better password or encryption systems to keep out unauthorized users, ex-hackers are often better grounded in the real-world challenges of keeping information secure than are most of the

former law enforcement agents, inventors of new security devices, and academics who have traditionally made up the information-security profession. "To understand a hacker certainly requires a bit of the hacker's mentality," says Stang. "Those kinds of people make good security officers."

One unlikely beneficiary of this kind of expertise is James V. Christy II, director of computer crime investigations for the Office of Special Investigations at Bolling Air Force Base in Washington, D.C. Christy tells of a young Washington-area hacker who had pleaded guilty to breaking into a Pentagon computer system. "We asked him to help us out," Christy says. "I sat him down in an office at Bolling and had him go in and attack as many Air Force systems as he could get into. We wired this kid up so that everything he did was recorded. Within 15 seconds he broke into the same computer at the Pentagon that he was convicted for, because its administrators still had not fixed its vulnerabilities. I had



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to go back the next day and tell the emperor he still had no clothes."

The unorthodox operation continued for three weeks. "During that time he broke into over 200 Air Force systems," Christy recounts. "Zero victims reported that they had been hacked into. Not one." Christy used these embarrassing results to press information-security officers throughout the Air Force to patch over long-neglected security holes.

Other government agencies, as well as firms like American Express, Dun & Bradstreet, and Monsanto, have also hired tiger teams to probe their systems' vulnerabilities. Former hacker Ian Murphy founded and led the Pennsylvania firm IAM/Secure Data Systems from 1986 to 1993, which performed such services as breaking into the headquarters of banks and insurance companies, logging onto their computer systems, then submitting detailed reports on how the penetration was accomplished. Murphy told *InformationWeek* magazine that he and his employees—all convicted computer felons—netted a peak \$500,000 per year for their services. Lawrence Livermore National Laboratory's Computer Security Technology Center, which tries to stay one step ahead of cracker intrusions at the Department of Energy and other agencies, has occasionally called on former hackers to lend their expertise as "subcontractors," says staff member Allan Van Lehn.

The most prominent hacker crossover success—and failure—was that of Comsec Data Security, a Houston consulting firm founded in 1991 by three former members of the Legion of Doom. Though the firm quickly built a client list that included several Fortune 500 companies, "media hysteria" and "blackballing" by competing Establishment firms cost the firm those same commissions and forced it out of business in 1992, says cofounder and former president Christopher Goggans. "There are a large number of people who would kill to do nothing but get paid to hack legitimately, so everybody in the hacker community was watching Comsec," says Goggans. "From the treatment we got, you can expect that hackers who want to sell their skills as information security consultants in the future are going to have to hide their backgrounds."

But Goggans himself has been an exception to that prediction. He has a job as an engineer for a major U.S. software firm, but he says his "career" is in freelance

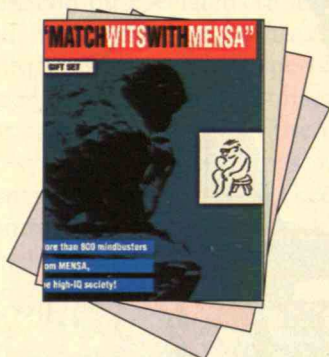
information-security consulting. In 1994 he led a three-day training seminar for 13 member nations of NATO at the Allied European Command Center at the Hague, and there are "financial institutions that want to fly me out at a moment's notice," he says. Other organizations' resistance to working with former hackers, Goggans suggests, stems from "fear of the unknown. But it takes only a few minutes of earnest dialogue before people realize that those like myself are not of a mindset to do any kind of damage to any company."





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If hackers have found it difficult to market their skills openly, there are less direct ways they can aid in the fight against computer crime. Information security consultants, including King, Stang, and experts at SRI International Inc., admit that they gather most of their information about computer-system weaknesses by frequenting underground bulletin-board systems and talking with hackers. "All of the good vendors in one way or another absolutely do that," says Stang. "There are some hackers who believe in 'full disclosure,'" notes Richard Feingold, project leader of CSTC's Secure Systems Services division, which helps government and corporate clients evaluate and reduce their risk from hacker attacks. "As soon as there is a new security vulnerability or technique out there, they will publish it on the Net. That's where a lot of our own techniques come from."

University of Dayton law student Jeff Moss—known to his former hacker compatriots as Dark Tangent—chips away at the wall of suspicion between hackers and security officials by inviting both to the "Def Con" hacker conventions he organizes annually in Las Vegas. The 300 attendees at 1994's meeting included such luminaries as Phillip Zimmerman, inventor of the Pretty Good Privacy encryption system, and Gail Thackeray, a Phoenix district attorney who helped organize the 1990 hacker crackdown of Arizona's Organized Crime and Racketeering Unit. "A lot of time was spent in substantive presentations," says Thackeray, including seminars on search-and-seizure laws,

hacker ethics, and technical hacking methods.

There is still some forbidden territory on both sides. Hackers are not yet lining up at the employment offices of the FBI or the Secret Service—their underground pasts would disqualify them from government service, in any event—and these agencies continue to gather all the evidence they can against hacker hobbyists, hoping eventually to bring security and predictability to cyberspace. But law-and-order for-

*"There are a lot of great former hackers out there who don't have time to go to jail."*

ces have begun to recognize that the typical hacker's mentality and motivations

differ crucially from those of the rare computer aficionado who is seduced by the Dark Side. "The predominating idea is that hackers are out there to steal data, but they are primarily out there for the thrill of the chase," says King. A greater threat by far to corporate information security, he says, comes from disgruntled or financially struggling employees.

Still, while hackers and their pursuers are coming together based on mutual interests, the two camps have only just begun to explore common ground. "Cooperation" is therefore not quite the right word for the new relationship emerging between those battering at the Net's electronic fortresses and those still trying to bar the doors. "Détente," an easing of tensions, is closer. ★

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# MITnews

FROM THE ASSOCIATION OF ALUMNI AND ALUMNAE OF MIT

APRIL 1995

## IAP Now Hardwired into Institute Life. . .

*... and like many things hardwired, it has benefited from occasional upgrades.*

IAP, the Institute's Independent Activities Period, opened its doors in January 1971. IAP was born at a time of creative ferment at MIT, as were UROP, pass/no-credit grading, and a number of programs that enabled freshmen to make their way through the curriculum in something other than perfect lockstep. Students quickly came to see it as essential to their survival and faculty came to depend on this time for research and course development. Twenty-five IAPs later, it has been lengthened and finally acknowledged as at least a potential component of the curriculum.

In 1971, the undergraduate student body—and the faculty—were relatively homogenous and the curriculum rigid. To create a segment of the Institute calendar when people would be expressive and inventive, everyone had to stretch themselves, and they did it with gusto.

Legendary figures were at hand: The IAP Guide listed opportunities to study strobo-

scopic light and sonar with Harold Edgerton, '27, ScD '31, or acoustics with Amar Bose, '51, ScD '56. A discussion group considered forming

a branch of Nader's Raiders in Boston, and students had an invitation from conductor Sarah Caldwell for "night-and-day work" filming segments of the opera *Louise*.

Over time, the eclectic character of IAP flourished. The range would typically extend from an introduction to the programming language APL, through the optical study of X-ray sources, and on to a three-week course in t'ai chi.





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MIT Adapts see page MIT 8

## IAP hardwired

continued

Nobel laureate David Baltimore, '61, shared his expertise on the causes of cancer, but fellow biologist (now professor emeritus) Boris Magasanik stepped out of character to share his expertise in African tribal art.

At around the same time that MIT was bringing forth IAP, other campuses introduced some form of "winter term." But the MIT version was, as far as anyone knows, unique, in that it truly was independent. Elsewhere, January might depart from the usual routine of lectures, laboratories, and exams, but students were required to do approved internships, independent study, and the like. At MIT students could do anything... or nothing. And there lay the rub for some faculty.

Some faculty were heard to speculate that students went skiing over IAP or otherwise engaged in lightweight activities, and that the creative intensity IAP was expected to foster was in short supply. At the same time, faculty were concerned that MIT had fewer teaching days in the regular term than its peer universities, and they saw IAP as at least partly to blame.

It was impossible to refute the complaint that students did not use IAP well. After all, requiring students to document how they spent their time would undermine the purpose of IAP—to allow for personal development and reflection. Many students who wanted to be more intellectually engaged were frustrated by the fact that few serious courses were offered, and those very quickly became oversubscribed. And it was true that MIT's two fourteen-week terms add up to a shorter than average academic year, while an IAP only three and a half weeks long did not allow enough time to do the kind of challenging work that faculty would respect.

At the same time, the demographics of MIT was changing—more women, more minorities. Just living in the residences and walking in the halls were more diverse experiences. New curriculum options were created in the humanities and social sciences, and departments offered minors for students with many interests. The shape of the hole that IAP might fill was not as it had been in 1971. "We were meeting the needs of all the students except those who

wanted an intensive intellectual experience during IAP," comments chair of the faculty Robert Jaffe.

The IAP issue came to a head in 1992, when the faculty added a biology requirement to the core curriculum. While admitting that the life sciences are essential to a modern science-based education, faculty recognized that they were stacking an additional burden on top of undergraduate programs that were already crammed and stressful. As a step toward amelioration of the problem, they called for a review of the entire academic calendar, including IAP.

The calendar committee, mindful of the desire for more teaching time, came back with a calendar that not only provided a four week IAP, but also lengthened the year by lopping two weeks off the summer break. This brought howls of pain from faculty and students alike, Jaffe says, because the summer weeks were essential for research, student jobs, and recharging personal batteries before the start of the year.

So Jaffe devised a compromise. First, both regular terms would be lengthened by a week, on average, with the proviso that the academic year would never start before Labor Day. IAP would be a full four weeks, but it would have a persuasive new rationale: the ban on *requiring* participation during IAP was conditionally lifted. Each department would have the option of requiring majors to take up to twelve units of credit during one IAP. In effect, this would add 20 teaching days to a typical four-year degree. The cap on the number of credits required for a degree stayed in place; departments may not add more course requirements—which reassures students that IAP will be used to reduce pressure, not add to it.

Even at four weeks, IAP forms a very narrow window. The faculty didn't want students to be penalized if they were unable to complete a required credit course during January of any particular year. So under the new policy, departments that employ the IAP-requirement option have to provide "roadmaps" to show how students could complete the requirement in a variety of ways—for example, during IAP of their sophomore or junior year.

The new calendar was approved in



**IAP's "Charm School" in session:** Far right: the head of the Graduate Alumnnae Program, Kathy Battillo, and Thomas Allen of the Sloan School (lower left) offered one-on-one advice to students in the class on *Overcoming Shyness*. Susan Allen and Eleanor Crawford, both from the Office of Undergraduate Education and Student Affairs, brought visual aids to their class on *Body Language*—help for people who are thinking "smart and suave" while their bodies are conveying "out to lunch and ner-r-r-vous."



the spring 1992. It was a step that Dean for Undergraduate Academic Affairs (UAA) Travis Merritt says is very significant. Merritt, whose office administers IAP, says that by facilitating a much more significant role for IAP and lengthening it, the faculty are finally settling the debate that has rumbled on for the past 25 years about whether IAP is really a valuable element of an MIT education. They said yes.

So what is IAP like these days, anyway? Well, for one thing, Jeff Meldman, '65 SM '70, PhD '75, is still offering the popular introduction to law that he introduced while a graduate student in 1971 (*see accompanying article*). Pro-

fessor Linn Hobbs's course on the fine points of wine—first offered in 1982—still fills up almost as soon as the *IAP Guide* comes out. Skiing, both alpine and cross country, are indeed popular.

Courses in designing and building robots and bridges engage students in 2.70-like competitions. Many departments offer modules on "tools." And MIT's Program in Environmental Engineering Education and Research notes with satisfaction that students could participate in some form of environmental studies just about every day of IAP '95.

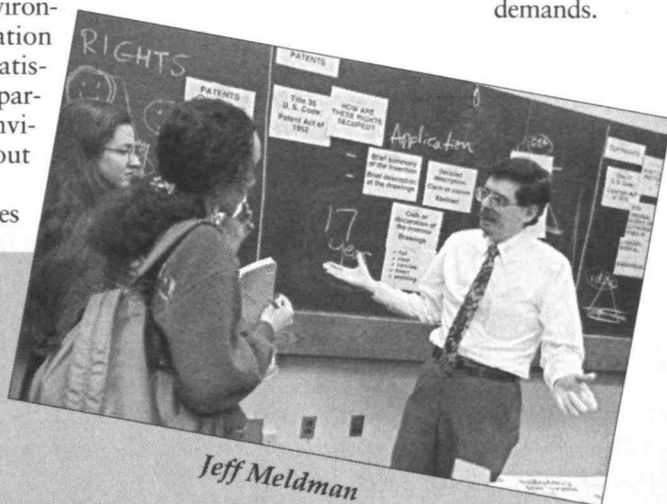
This year, 81 credit courses

were offered—a record—and although at press time it was too early to say for sure, 1995 enrollment was comparable to the more than 1,000 students who signed up for credit courses in 1994. Students in these classes are discovering (with their professors) the intense satisfaction of 40-hour weeks immersed in topics like special relativity, with no competing demands.

## Law for Techies

In 1971, when he decided to offer "A Brief Introduction to Law" during the first IAP, Jeffrey Meldman, '65, SM '70, PhD '75, had two MIT degrees in electrical engineering and a Harvard degree in law to his name and was back at MIT as a doctoral student in Course VI. Twenty-five years later, he is a senior lecturer in computer law and director of undergraduate programs in the Sloan School and an associate dean in the MIT Office of Undergraduate Academic Affairs—and he is *still* offering his IAP law course.

The course consists of five two-hour lectures, by Meldman or another of the lawyers who teach at MIT, on such subjects as torts and contracts, international law, and civil rights and civil liberties. On the day that *Technology Review* stopped by with a photographer, Meldman himself was holding forth on patents and copyrights to a packed lecture hall. His demonstration of the evo-



Jeff Meldman

lution of patentable improvements in a plastic corn butterer had to be seen to be believed. Nobody, but nobody, was dozing off.

Of course, teaching at MIT has its own rewards and surprises: one of the students in the room was able to help move the discussion along by discussing the process through which he had already obtained a patent on his work.

That Meldman has tapped into a topic high in the priorities of MIT students was evident at the end of the lecture, when he was surrounded by students wanting to ask questions and continue the discussion. □—S.L.



## IAP hardwired

*continued*

Mary Enterline, associate dean of UAA and coordinator of IAP, notes that many students earn thesis credit during IAP and that other students are busy with credit-bearing UROP projects. (Since UROP credit often does not show up on a student's transcript until the end of the spring term, it is an underreported aspect of IAP.)

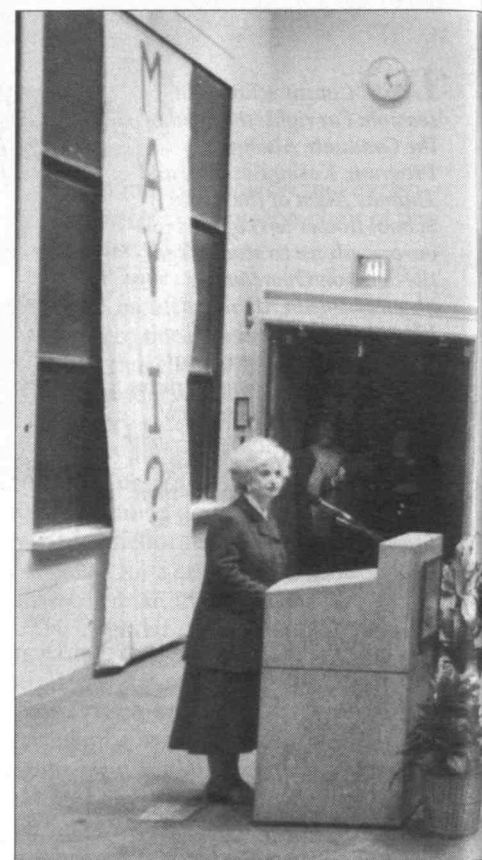
Starting with IAP 1996, the Department of Physics expects to require all of its majors to take one IAP subject for credit, and the department developed two electives from which students may choose. The Department of Earth, Atmospheric, and Planetary Sciences offers its required field schools in the American Southwest during IAP. Several additional departmental proposals to take advantage of the requirement option are in the works. (Such changes in the curriculum go through all the usual checks and faculty scrutiny before they become official.)

On the light side, IAP now includes "Charm School," an only slightly tongue-in-cheek program to help MIT students have fun while acquiring a few of the social graces they will need if their careers and personal lives are to come up to the stature of their academic credentials. (See accompanying article.)

Are there any enhancements that might be made to IAP? Well, yes, as a matter of fact. Travis Merritt would like to see alumni and alumnae helping to lead more activities, particularly in collaboration with their "home" academic departments. He thinks team teaching could be particularly rewarding per hour invested. It's not too early to start planning for IAP 1996, and Mary Enterline in the UAA Office would love to hear from you at (617) 253-1668, or <mzen-terl@mit.edu>. □ —SUSAN LEWIS

## Miss Manners the High Point of Charm School

Judith Martin (Wellesley, '59), known to hundreds of thousands of newspaper readers as Miss Manners, was the surprise hit of IAP '95 (to say nothing of being the feature of IAP covered by *Good Morning, America* and several print media.) Though some readers (this writer, for example) of her advice column are looking for a chuckle and a witty retort on such sticky matters as wedding invitations rather than a roadmap through life, she made a surprisingly scholarly case for considering

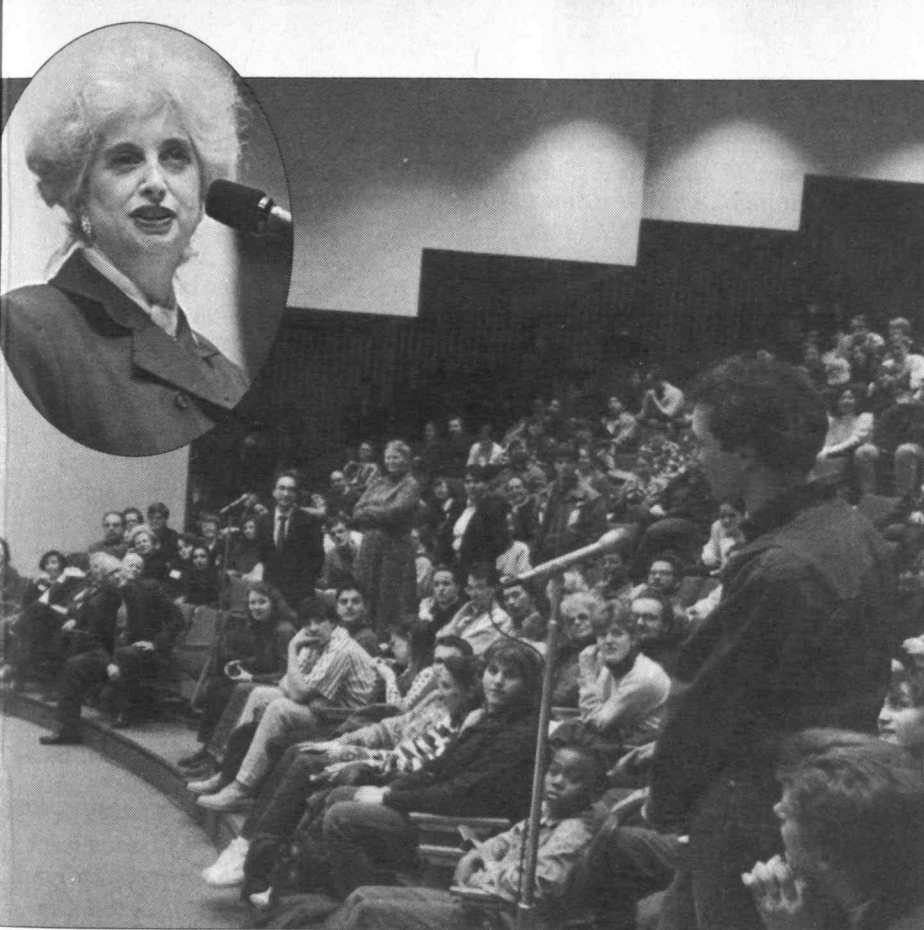


manners a *very* serious business. Columnist George Will is reported to have said of her, "She has access to the stone tablets that Moses mislaid."

Miss Manners was invited to MIT to give the "commencement address" for







*Judith Martin, known to newspaper readers as Miss Manners, delivered the Charm School commencement address to a packed 10-250 during IAP, and members of the audience lined up to quiz the nation's authority on etiquette. The young man at far right asked her to settle an argument about telephone use that raged in his household. "Call waiting," Miss Manners averred, "is rude."*

"Charm School," an IAP offering that involves more than a score of instructors from all domains of the Institute. They spend several hours coaching a few hundred MIT students in such refinements as how to tie a bow tie, pedes-

trian-friendly strategies for navigating the Infinite Corridor, and polished performance in job interviews.

Charm School was intended to offer useful advice and a general good time. When it was launched three years ago, nobody expected Lobbies 7 and 10 to fill with students firing questions at the instructors. But this is MIT. If students do something at all, they do it intensely. Alberta Lipsom, the assistant dean of UAA and the "head-mistress" of Charm School, now knows that no matter how many seats around the table she has for the sessions on table manners, there may not be enough.

Miss Manners spent her afternoon on campus observing this training of young warriors in the battle against incivility, and she noticed the session on "Internet Etiquette." Maintaining standards of behavior online presents serious obstacles, she said in her address, because people are not dealing face to face, possibly not even using their own names, so the usual social pressures are hard to apply. She suggested that MIT is on the cutting edge of network etiquette and that some students might even want to consider careers in her profession.

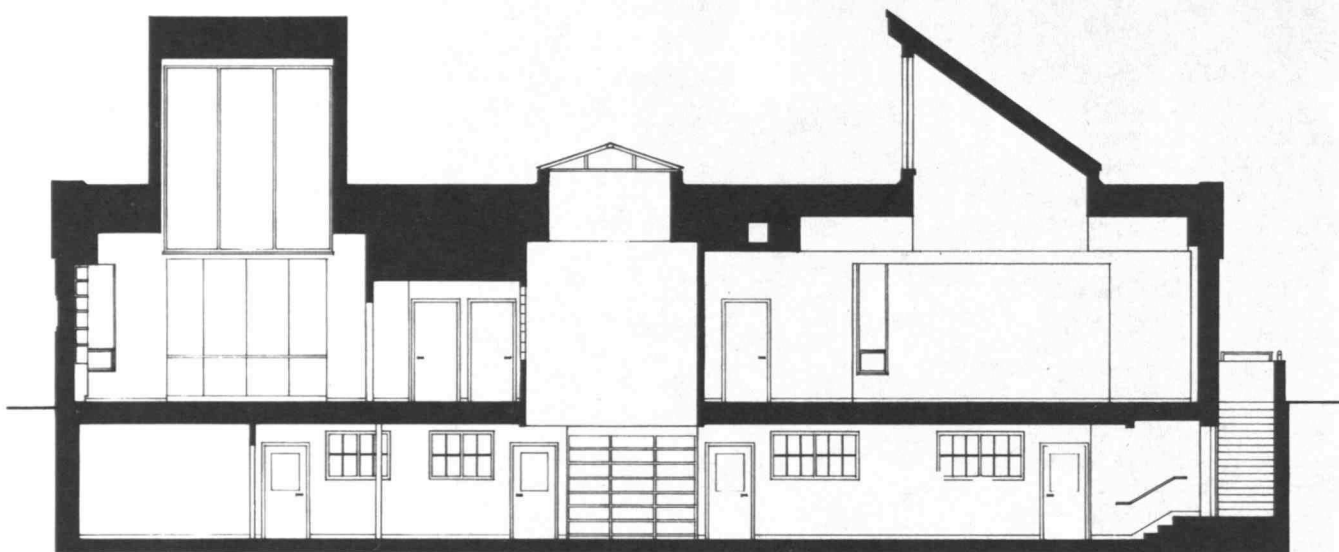
She won her audience over by declaring at the outset that she saw no contradiction between nerdiness and charm. "What I find unattractive," she said, "is empty-headedness, especially when crowned by arrogance. Ignorance is never charming."

Noting that understanding of "the principles of etiquette is essential to the educational process," she said that "free speech is not what a university is about, but rather free inquiry." And free inquiry, she went on, is impossible in a climate where the rudest, most insistent people—regardless of rank—are imposing their ideas on everyone else.

In a one-hour lecture, Miss Manners listed three forms of etiquette: regulatory etiquette, as in not interrupting others; symbolic etiquette, as in showing respect for one's profession and one's colleagues by wearing a tie; and ritualistic etiquette, as in fulfilling the human need for ceremony through the traditions governing weddings or formal dinner parties. The purpose of such standards of conduct is not to humiliate the uninitiated, she emphasized, but to grease the wheels of human interaction and make it possible for us all to live on the planet without driving each other crazy. □—S.L.

**Charm School organizers recruited one of MIT's most eminent authorities to teach the class on "Buttering Up Big Shots": Paul Gray, chair of the MIT Corporation. Gray says he was a little skeptical, but 90 minutes of responding to "sensible comments and questions" about how to interact with influential people (say, someone in a position to offer you a job), and he "came away thinking that this is a good thing to do."**





## Religious Activities Center: A New Life for W11

BY ROB BLEZARD

*It's difficult to illustrate without a three-dimensional model or a lot of color photographs, but MIT's new Religious Studies Center (W11), is flooded with light. The two large roof projections are "roof monitors"—a form of skylight with the glass perpendicular to the roof surface that brings copious but non-glaring light into the spaces below. (The monitor at left faces the viewer; the monitor at right faces left.) The shallow skylight in the center of the building caps a "light well" that channels light all the way down to the basement level, where farmhouse windows and glass panes in the doors feed light into chaplains' offices. Visitors and tenants all agree that the architects, Ondras Associates of Cambridge, have really transformed the building, which once housed the Center for Advanced Visual Studies.*

**M**iriam Rosenblum remembers the reaction when chaplains and religious staff serving MIT heard they would have to leave W2a, their homey brownstone on Memorial Drive, for W11, the industrial-grade building at Amherst St. and Massachusetts Ave. that had housed the Center for Advanced Visual Studies (CAVS) for decades.

"I think everyone's heart sank a bit," said Rosenblum, Jewish chaplain and director of Hillel. Old and creaky, the brownstone nonetheless possessed warmth and a spectacular view of the Charles River. W11, on the other hand, exhibited all the charm of a welding shop. The lighting that had worked for the high-tech artists of CAVS—consisting of "roof monitors," vertical skylights high overhead (*see drawing*), and only four eye-level windows—seemed particularly unsuited to the building's new occupants.

So it was a pleasant surprise when

Rosenblum and her colleagues last summer found themselves in accommodations that had been gutted and renovated with considerable thought, at a cost of nearly \$2 million, and renamed the Religious Activities Center (RAC). "When students come in who have been here in the past and see what wonderful facilities we're in now," says Rosenblum, "their mouths just drop open."

Chaplains and MIT administrators alike credit the architects, Ondras Associates of Cambridge, for the miracle. To give the nearly windowless place a cheery feel, Ondras maximized the light from the roof monitors and employed inviting colors. Most impressive is the "light well," a horizontal skylight that conducts light all the way down to the basement, spilling it into a common room and from there through broad, farmhouse windows into the surrounding offices for the chaplains. "We had to push a lot of light there so it didn't

feel like a basement," notes architect Martha Ondras, MAR '74.

Having decided to use W2a for additional housing for the growing number of undergraduate women, MIT officials took the opportunity not only to relocate the chaplains but also to consolidate under one roof the other religious functions that had been scattered throughout campus. For example: though Hillel had offices in W2a, its kosher kitchen and sanctuary were in Walker; the Moslem community met for prayer in Ashdown; and student Christian groups had offices in the Stratton Student Center. When CAVS moved to join other architecture-related activities in N52 (the MIT Museum building), it freed up just about the right number of square feet to serve the religious needs of the estimated 20 percent of the MIT student population who participate in such programs.

The new center also stands to serve



important philosophical and educational objectives, in the view of Robert Randolph, associate dean of undergraduate education and student affairs. When groups were located here and there about campus, Randolph says, members could avoid encounters with people adhering to differing beliefs and never be challenged to accommodate other points of view. "One of the intentions of this [consolidation]," he says, "is to create an atmosphere where there is bound to be some rubbing and some friction and some conversation, and ultimately, I hope, some education as a result."

The original vision of Kresge Auditorium as the fulcrum of campus religious life, as evidenced by the choir loft on one side and the cathedral-scale pipe organ on the other, has not materialized, but the Saarinen-designed Chapel admirably fills its intended role as an intimate space for small-group worship. Now the RAC provides the final element of the plan: offices and spaces for prayer and other gatherings almost adjacent to the chapel. "Thus, in some way," says Stephen Immerman, director of special services in the office of MIT's senior vice-president, "the renovation of W11 is the completion of a long-unfinished agenda." □

#### TECHNOLOGY DAY 1995



## World War II: a Global Ordeal, an Agent of Change

**M**IT and the rest of the world would have undergone vast changes in the last 50 years, regardless. But much of the history since 1945 was set in motion by the events of World War II, and MIT is a superb vantage point from which both to assess this momentous period and to speculate about what's ahead in the next half-century.

It was with this in mind that the Alumni/ae Association's 1995 Technology Day Committee organized a program entitled "War, Technology, Peace, Change," to mark the 50th anniversary

of the end of the war. The program will be dedicated to the memory of Jay Stratton, '23, and Jerry Wiesner. Each was a member of the Radiation Laboratory, one of MIT's most critical contributions to the war effort, and each went on to become president of the Institute and a national leader in the post-war world.

T-Day is the largest single gathering of MIT alumni/ae, the focal point around which all reunion activities revolve, and it will be held this year on Friday, June 16. The day will have the now-familiar structure: the Memorial Service to honor those alumni/ae whose deaths were recorded in the 12 previous months, a morning program in Kresge Auditorium, the traditional luncheon at which reunion classes present the results of their fund-raising efforts, and finally a series of afternoon panel discussions, exhibits, and tours.

Keynote speaker for the morning program will be historian Doris Kearns Goodwin, author of a recent, much-praised biography of Franklin and Eleanor Roosevelt. Goodwin's theme will be "WWII: Imperative for Democracy," a look at the pressures that made U.S. entry into the war inevitable. Robert Seamans, '42, ScD '51, senior lecturer in aeronautics and astronautics and former head of NASA, will provide a "snapshot" of MIT's wartime programs of research (on such technologies as guidance systems) and educating the military (such as V-12), while Corporation Chair Paul Gray, '54, ScD '60, will discuss the changes in the way MIT does business that grew out of those programs.

Lester Thurow, former dean of the Sloan School and arguably the most quoted economist in the country, will consider the economic impact of the war on society. Sheila Widnall, '60, ScD '64, professor of aeronautics and astronautics (on leave) and secretary of the Air Force, will talk about the impact of the war on university research in this country. And President Charles Vest will outline his vision of how MIT will build on all that history in the next 50 years. The T-Day audience, as always, will have an opportunity to ask questions.

The afternoon program will apply the expertise of MIT faculty to questions that go far beyond the borders of the campus, including: The economics of war—is peace affordable and is peace-keeping practical? War and accelerated social change—what comes next for

families, individuals, and political entities that grew up in the shadow of WWII and the Cold War that followed? Ethics, technology, and conflict—is there a role for ethics in conflict management and technology development?

The agenda for Technology "Day" is really more than 24 hours can accommodate. Participants also will be offered Saturday guided tours of laboratories that either originated in the pressure cooker of the war or were developed on an interdisciplinary laboratory model that was elevated to a high art during the war. And the day officially starts on Thursday evening with the Boston Pops concert at Symphony Hall, which this year will feature performers and compositions from the Music and Theater Arts Section of MIT's Department of Humanities—along with tunes dear to the hearts of every war veteran (and fan of old movies).

This year, *Technology Review* will help set the stage for T-Day with an article scheduled for publication in the May/June issue based on a panel discussion on the war's impact on science and technology. MIT luminaries Jay Forrester, SM '45, and Philip Morrison will be joined by physicist/policy analyst Harvey Brooks (Harvard University), historian Alex Roland (Duke University), and other scholars. The panelists are all well positioned to analyze the changes in government, industry, and academia during the war, as well as the technological innovations fostered by these new structures and the ways these changes have affected the R & D enterprise ever since.

Paul Gray describes WWII as the only external "transforming event" to dramatically alter Institute history in this century, but that is not to say that no other modern war has had an impact on MIT. James Draper, '62, PhD '75, chair of the Technology Day Committee, and his fellow planners were conscious that 1995 is not only the 50th Reunion for the Class of '45, with its memories of heroic effort and sacrifice, it is also the 25th Reunion of the Class of '70, whose college years were colored by the Vietnam War. In setting up the program, the committee worked closely with both classes. □ — SUSAN LEWIS

*Alumni/ae who need more program details should contact the Alumni/ae Association T-Day office at (617) 253-8230, or send e-mail inquiries to <edame@mitvmc.mit.edu>.*



# Striving To Rem

*As it feels the seismic rumbles of change, the Massachusetts in a world where research money is scarce and graduates are*

BY JOHN POWERS

*This copyrighted article was first published in the Boston Globe Magazine on January 15, 1995. John Powers talked to many people at MIT, and it's safe to say he listened closely to the answers, because he reports on many of the issues and views that MIT's leadership considers most important in the 1990s. We reprint the article for alumni/ae readers with permission, adding only a few of our own footnotes. — Ed.*

Charles Vest, the 15th president of the Massachusetts Institute of Technology, sits in his sunny office overlooking the Charles River, ticking off the seismic rumbles his institute is feeling these days. Portraits of founder William Barton Rogers and former president Karl Compton gaze across at him with expressions somewhere between alarm and empathy.

"The end of the Cold War," says Vest, who came to 77 Massachusetts Avenue less than one year before the Soviet Union came unglued, in September 1991. "The globalization of virtually everything and America's competitive position within it. The information-technology revolution. And the incredibly rapid demographic changes in America."

As the nation's greatest institute of technology, MIT has been in the forefront of most major scientific advances since the Civil War. Its professors have won a dozen Nobel prizes, and its alumni have walked on the moon. Its presidents have had the ear of US presidents.

Now, at a time when Washington has

no science policy, when Congress is pulling money out of research, when American industry is downsizing, when the country is dealing with its largest immigrant influx in nearly a century, when universities are under uncommon scrutiny, and when engineering grads are seeking MBAs and applying to medical school, Tech is trying to reposition, rethink, and reengineer itself, while the rest of the country watches and takes notes.

MIT isn't alone. Harvard University, its neighbor "up the creek," is trying to centralize its Balkanized empire of graduate schools and raise \$2 billion, while its exhausted president takes time to recharge his batteries. But while all universities are feeling one or more of the seismic rumbles, MIT is feeling all of them. The end of the Cold War decimated the budget of the Pentagon, which has steered billions of dollars Tech's way since World War II. As globalization has forced American business to remake itself, industries that have employed thousands of MIT grads—defense, aerospace, oil, automotive, nuclear energy—are either in eclipse or stagnant. Others that used to knock primarily on Ivied doors, like finance and management consulting, now are showing up at the Great Dome, pushing MIT to further broaden its science-heavy curriculum.

The information-technology revolution, much of it fueled by MIT grads "hacking" in garages, continues at warp speed, while Tech scrambles to keep pace. And as the '80s tide of multicolored and multicultured newcomers produces more college-age students, the institute is trying to become more diverse without sacrific-

ing the academic rigor that has been its hallmark for more than a century.

"How does this place do it?" asks Vest, who was provost at the University of Michigan, in Ann Arbor, before he came to Tech. "With great stress and debate and tension. But it does do it. Department by department, lab by lab, unit by unit, people are adapting. But there is some denial going on, without question." Vest's role is to act as seismologist, soothsayer, lookout, preacher, referee, summarizer, interpreter, lobbyist, confidant, and herdsman. "My job is to get out there in the world and bring information back," says Vest, the first MIT president in six decades with no previous ties to the institute. "To wheedle, to push, to shove, to get people to think about the issues—but not define the solutions to them."

Tech people are used to finding solutions on their own. It's their occupation, their hobby, their passion. Vest's mission is to keep bringing them the problems. Some are what Vest has called "challenging external forces," like federal budget cuts, congressional investigations into research costs, changing public attitudes toward universities, and the sorry state of math and science instruction in elementary and high schools. Others involve the institute itself—dealing with a current \$6 million budget deficit, creating a student body that looks more like America, shaping the curriculum to keep pace with a changing world, and reengineering MIT to make it run more efficiently.

"The big mistake we can make if we're not careful," says Vest, "is mistaking our uniqueness for never having to change. You can't say, 'Everything was fine in 1955.'" The MIT of 1955 and the America of 1955 have vanished.

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# main "Useful"

*Institute of Technology is trying to reposition itself  
being lured out of the lab and onto Wall Street.*

A glance at the faces along the so-called infinite corridor, the spine that links five buildings under the Great Dome, makes that obvious.

Tech's student body is nearly 35 percent female, 30 percent Asian, and 15 percent black, Hispanic, and Native American. And these students aren't about to take their bachelor of science degrees and sit in front of a computer screen or squirrel themselves away in a laboratory. "Students will be leaving here and doing very different things," says Vest, who has been urging engineers to see their work in a broader social context. "If we look back 10 years from now, I would bet we see a restructuring of engineering education just as profound as what happened in the '50s and '60s. We're going to veer off on a different track."

**S**erge Adam keeps trying to assure his parents that the world won't end if he takes his mechanical engineering degree straight to Wall Street. "They try to talk me out of it," he says. "They say: 'Do like your brother. At least get a master's.' I say: 'Don't worry, Mom. I'll work for two years, then go off and get my MBA.' But it's hard to persuade them that it's a good career choice."

Time was when a "Mech-E" left MIT and went to work for Ford or General Motors. Not in the '90s. "Most of my friends aren't going into engineering," says Adam, who'll graduate in June. "We're all looking at Wall Street or management consulting. People consider engineering slow now. It's 9-to-5, 9-to-5."

Every afternoon, you can walk into MIT's office of career services and see half a dozen seniors in business suits waiting to chat with interviewers from

J.P. Morgan, Goldman Sachs, McKinsey, and Arthur Andersen. They will be invited to dinner Upstairs at the Pudding. They will be flown to New York and Chicago. They will be hired at semi-princely salaries. Most of them will never see the inside of a research lab.

Nearly a quarter of the companies recruiting at MIT last year were financial or consulting firms, and that hasn't changed. "There are students getting PhDs in math and chemistry who wouldn't let their professors know for a moment that they're thinking of Wall Street," says Bob Weatherall, who directs the career services office. "They think it would ruin their reputations."

MIT students, Weatherall says, are like beagles, sniffing something intriguing in the wind, then dashing off in pursuit. For a time, they headed off to US Steel and Gulf Oil, then to McDonnell Douglas and Martin Marietta, then to Wang and Digital. "Now, the beagles are running hard to management consulting and finance," says Weatherall. "They're alert to where they think the upward and downward movement is."

Weatherall could have told you that IBM was headed for trouble in the '80s because the beagles found it humdrum. These days, you can't give away nuclear engineering. Only four sophomores are majoring in it. Three times as many MIT sophomores are majoring in biology as in civil and environmental engineering. "Exxon sent someone here to do a focus group on what students thought about the oil industry," Weatherall says. "Sunset industry," one of them said. And with the Soviet Union broken down into molecules, the defense industry is shrinking rapidly. So Tech grads are going where the jobs are, and if they don't seem like traditional engineering

jobs, it's because what the world wants from engineers is changing.

William Barton Rogers didn't know from risk arbitrage in 1865. He wanted to create a "polytechnic school of the useful arts... suited to the various practical professions of the mechanic, the civil engineer, the builder and architect, the mining engineer, and the practical chemist." Rogers' school would also teach special industrial pursuits like the "direction of mills, machine shops, railroads, mines, chemical works, glass, pottery and paper manufactures, and of dyeing, print, and gas works." Not to mention navigation, surveying, telegraphy, photography, and electrotyping. In short, everything "useful" that they weren't offering at Harvard.

Fifteen students—some of them professional artisans, some of them teenagers—gambled \$100 on Rogers' vision and came to MIT's one-building campus near Copley Square, where they got a thorough grounding in machines. That was what an engineer did. He (it was almost always a he) took things apart, improved them if he could, and put them back together. The pure science, the vision of the unlimited frontier, the stunning breakthroughs that produced the nuclear, aerospace, telecommunications, computer, and biogenetic ages, came later.

**M**IT professors and graduates designed some of the first computers, perfected radar, worked on the atomic bomb, helped put rockets on the moon, and discovered how RNA becomes DNA. What they all had in common was that they were doing research and doing it in a lab. Their work took years, sometimes



# MIT president Charles by department, lab by are adapting. But there

decades, most of it solitary. When you saw pictures of Tech's scientists, they were usually wearing a lab coat, a necktie, and glasses and standing in a thicket of tubes and wires and gauges. Or they were wearing a tuxedo in Stockholm, accepting their Nobel from the King of Sweden. You didn't see them on a trading floor.

**Y**et the class of 1995 sees no disconnect there. What McKinsey and Salomon Bros. want from the MIT graduate is the same thing that the Big Three and the aerospace firms and the oil companies and high-tech startups wanted. "They want people who can think hard and quick," says Adam, "who are good with numbers and who can solve problems."

Problem-solving is still MIT's calling card, but America's—and the world's—problems are more complex than they used to be, and the solutions need to involve more people across more disciplines. The buzzword at Tech is "context." Working out solutions in a lab now has to factor in the business, organizational, social, political, economic, environmental, and cultural context of the problem.

That's postmodern engineering, or "engineering with a big E," as engineering school dean Joel Moses calls it. "We want to produce students who are ready to go to work," says Robert Jaffe, who chairs the faculty. "Students who have creativity, a long-range view, and analytical skills to solve the hard problems they'll encounter anew."

So MIT has revamped its curriculum to offer a bachelor's and master's degree in five years in four disciplines. The Leaders for Manufacturing Program between the School of Engineering and the Sloan School of Management allows students to earn a master's degree from

each in two years. Tech is working on a "second professional degree" program to offer to engineers who've been in industry for five years and need to change gears. The institute is also teaching students to work in teams, just as they will in the real world.

With research money dwindling, that real world has become a more attractive—and lucrative—place for Tech grads. The lure of the lab, of working for a decade on a breakthrough that could change the world, is not what it was in Vannevar Bush's day. Not when Congress yanks the plug on the super-collider on short notice.

There was a time when it seemed that the money would flow forever. World War II had evolved into the Cold War, and Washington was buying science seven figures at a time. The research contracts came to MIT from everywhere—Defense, Energy, NASA, the Atomic Energy Commission, the National Science Foundation, the National Institutes of Health. "I've often thought how much fun it must have been to be president here in 1960," says MIT corporation chairman Paul Gray, who served as president from 1980 to 1990, "when the government was throwing money at this place faster than you could figure out what to do with it."

**T**he megabucks began winding down as the Vietnam War did (except for a Star Wars spike during the Reagan years) and have leveled off since the breakup of the Soviet empire. MIT's off-campus Lincoln Lab, which does classified, defense-related research, has lost one-third of its federal funding since 1990.

Tech is still getting substantial sponsored-research cash from Washington—\$270 million on campus this year. But

it's coming with more strings attached and much more scrutiny, ever since the indirect-costs controversy that involved nearly two dozen universities and prompted the resignation of Stanford University president Donald Kennedy. The controversy also included MIT, which agreed to repay more than \$700,000 in public funds spent on items like dinners, flowers, alcohol, and a trip to Barbados.<sup>1</sup>

Back when the government was fretting about Nazi mad scientists or Sputniks, nobody worried about costs, indirect or otherwise. And nobody questioned the partnership between Washington and research universities. Now, in a time of revolving-door presidencies and a skeptical, if not hostile, Congress, MIT's president finds himself on Capitol Hill once a month, explaining what Tech and places like it mean to America and why the partnership needs to be rebuilt.

"The primary message Washington was hearing was: Give us more money and leave us alone," says Vest, who opened an MIT office in Washington four years ago. "We were guilty of an attitude that was pretty smug, saying, 'Trust us.' That doesn't work these days."

Rebuilding trust is only one of Vest's challenges. The other is persuading a government hooked on sound-bite solutions to take the long view on science and invest in research that may take years—or decades—to pay off. Back when administrations lasted longer than a quadrennium and Democrats ran Congress, selling the long view was easier. But November's electoral upheaval has forced Vest and his kindred spirits to return to "Go."

"The institutional memory is walking out the door," says Jack Crowley, who directs MIT's Washington office. "One phrase Chuck uses is 'the educable



# Vest says, "Department lab, unit by unit, people is some denial going on. . ."

moment.' Well, you have to consider this an educable moment." Yet even if Vest can sell the long view, the money is still going to be shorter than it was when Washington was fixated on the Kremlin. The days when MIT's sponsored research doubled every four years are over.

**L**inking arms with Washington was a Faustian bargain to begin with, campus critics say. If Tech hadn't gotten hooked on "soft dollars" back in the '40s, it wouldn't be facing such a squeeze today. That's Monday-morning quarterbacking, says Paul Gray. "You'll find around here a set of people who will say it was a terrible mistake, that there was too great a reliance on soft money, that MIT should not have leveraged itself," he says. "Well, it didn't seem like a mistake at the time."

MIT is gradually weaning itself from soft dollars and has made a point of "hardening" faculty salaries with institute funds rather than research money. "We've got to back off that limb," says Vest. "And we're doing it very rapidly at a time when some schools are trying to get out on it."

To help make up for the drop in federal funds, Tech is looking more to industry for sponsored research. As corporate America has been downsizing, it's been scrapping its medium-to-long-term R & D labs. MIT can help there.

Tech officials concede that they can never replace government research with industrial research; industry already supports more research at MIT than at any other school. And they understand that the competition for all grants and contracts has become fierce. "Just because your proposal says 77 Mass. Ave. doesn't necessarily mean you're going to get funded," says Norris. "There are good people all over the country. You

have to continue to do the best work."

Other places call it downsizing, belt-tightening, shrinking. Only at MIT would they call it reengineering.<sup>2</sup> The institute has a structural deficit of \$10 million, largely caused by indirect research costs that Uncle Sam won't pay for anymore. So the administration has two choices: Keep the machine running as is and dip into the \$1.4 billion endowment, or reengineer it to make it run more efficiently, trimming \$25 million in the process. "Among some people here, reengineering will be considered sloganism," says Mark Wrighton, the provost. "But there is a big sense that things can be done better. And they understand that MIT is not alone."

The idea of reengineering appeals to the Tech passion for tinkering. But what Wrighton<sup>3</sup> is directing is actually a major overhaul of everything from MIT's appointment process to how campus mail is delivered. He would like to do it as subtly and as painlessly as possible. But departments will be shrunk and jobs will be lost and noses will be put out of joint. Wrighton is clear about that. And since the administration didn't want to impose across-the-board cuts, some changes have appeared arbitrary. "Every decision seems to be arbitrary if it's adverse," Wrighton says with a shrug.

The problem is, there is very little at MIT that is mediocre. Virtually all of its academic departments rank among the top five in the country in their field, and many are either first or second. "It is extremely difficult to stop doing things at an institution like this," Vest says. And getting consensus from a 1,000-member faculty, all of whom are used to lots of running room, is difficult. "It's like herding cats," says Paul Gray. "It's not done very efficiently."

But the alternative is a clanking

machine—a kludge, in Techspeak—bleeding red ink into the next century. Dipping into capital is not a solution, not at the problem-solving center of America. Reengineering is. "I tell the students that we're trying to make sure that this is an institution that you'll be proud to have your degree from in 20 years," Wrighton says.

The admissions video comes right out of MTV. Harpsichord music giving way to hard rock. Quick cuts, close-ups, goofiness. White-smocked scientists in a passionate embrace. Fifties-style families shooting graduation pictures. It's a self-mocking swipe at the Nerd Central image, aimed at the high school senior who thinks that MIT is anything but user-friendly.

The myths and fears about Cambridge Tool & Die, set in concrete after 130 years, are addressed head-on: "Will I have any fun? Do I have to be a genius? Do normal people go here? Are the faculty even vaguely human? What if I totally crack? Does anyone actually make it out?"

"We do have this image of being an impossible place to handle—and we reinforce that by the decisions we make," says admissions director Michael Behnke. "Every time we turn down a valedictorian with an 800 on the SAT, everyone in the junior class sees what we did and says, 'Well, if he didn't get in . . .'"

**M**IT easily could fill an entering class with valedictorians, but it also needs violinists, field-hockey goalies, Shakespearean actors, and what it considers "underrepresented minorities"—blacks, Hispanics, and Native Americans. Getting them means cracking the stereotype of the MIT student that has been in place since before Sput-



# ... The big mistake we can mistaking our uniqueness for

nik: the flannel-shirted, desert-booted male mechanical engineer with his head tilted 10 degrees, his trouser cuffs halfway up his shins, a T-square hanging from his belt, a row of pens in his chest pocket, and a glaze in his eyes. When Behnke tells high school guidance counseors that 40 percent of Tech's entering class is female, jaws drop.

MIT realizes it can't avoid the nerd label, so it deals with it directly in its admissions brochure: "Nerd city. A place where everyone talks in numbers, chats via e-mail, and studies all night. Yep, that's MIT. The buildings and majors and classes have numbers instead of names. The place is swarming with rocket scientists, computer scientists, social scientists, and probably a few mad scientists. And students never leave the lab. No parties, no dates, no fun. No way."

Tech students do get out from under their thermo texts once in a while. "I was expecting I'd go into my room, spend my 12 hours studying, go to sleep, and go to class," says Ted Hill. "I was surprised at how socially integrated the students were." MIT even had a homecoming weekend this past fall, before the football game with Curry College, that included a pep rally, a scavenger hunt, a barbecue, and an R-rated hypnotist.

**S**till, Tech doesn't try to pass itself off as Princeton with a little more physics. "We try to make it clear that we're a pretty techie place," says Behnke. "To be happy, you have to be interested in science and math, because we approach so many things quantitatively."

The curriculum is loaded with nuts-and-bolts offerings. Freshmen take calculus, physics, chemistry, and biology, even if they want to major in music and theater arts. "We have a core of very rigorous courses that we expect everybody to take, no matter what their major," says Vest. "We don't have

physics for humanities majors, physics for engineering majors, and physics for physics majors. We just have physics."

It is, after all, an institute of technology. Its official seal says it right up front: Science and Arts. The average math SAT of the entering freshman is over 740 on a scale of 800, and the application specifically requests a recommendation from a math or science teacher. And while MIT does turn down valedictorians, it did accept nearly 600 of them last spring, and nearly 90 percent of the incoming freshmen ranked in the top 5 percent of their high school class.

**F**act is, Nerd Central is one tough school, and most freshmen ask themselves the same question before long: What am I doing here? Vest tries to reassure them when he greets the entering class each September. "I'm here to tell you, it's not a fluke," the president says. "You belong here." Getting students to *feel* as though they belong has been a greater challenge. For generations, the engineering world and MIT were white-male preserves. The adjustment has not been without strain. Sexual harassment has been an issue at Tech, along with racial stress and homophobia. "These aren't all angels wandering up and down the corridors," says Art Smith, dean for student affairs. "But given the magnitude of the changes here, I'd say we're managing pretty well."

A bulletin board along the infinite corridor warns students about the danger signs of anorexia and bulimia. The MIT Pagan Students Group is looking for members. A poster inside Building 12 advertises movies from mainland China. In the main lobby, an African-American student at a microphone talks about the black holocaust. The gay and lesbian society announces a "honeypot jam." The *Thistle*, an alternative publication, urges students to "deconstruct everything, systematically whine about

systems, join the hordes of politically-correct oppressors, and fight sexism, racism, homophobia, classism, and military research at MIT." This is not Karl Compton's institute.

MIT is not only more diverse than it's ever been, it's more diverse than its students' own hometowns. They come from all 50 states and 100 countries. A third of them live in a home where English is not the first language. Then, they're thrown together into a four-year pressure cooker and asked to appreciate one another's differences.

"We have a difficult time getting into each other's heads," says Ellen Harris, associate provost for the arts and chairwoman of MIT's committee on racial relations. "There's a lot of: 'You don't know what this is like for me.'"

So Tech has produced three videos, by black, Asian, and Hispanic students, which talk about their experience here. The Asian-Americans are in a peculiar limbo: They're minorities, but they're not underrepresented, and it's assumed they'll excel. The African-Americans and Hispanics feel that they're not expected to succeed. The women have been here since 1871 and may comprise half the student body by the end of the decade. Yet some of them still feel alien in the "techie" environment.

"The growth in the numbers of women here was so rapid that there was a significant period of adjustment—particularly generational adjustment," says Vest. "I think we've pulled out of it. I think racial relations are extraordinarily good. They're not perfect. We do have some problems, but when they've arisen, people here are very upfront about them. They don't slink off in a corner and stew about it."

It is part of the problem-solving culture. The challenge lies in giving every group space and making them all feel they have equal standing without splintering the campus. "You shouldn't have to explain why you're here," says Harris. "For years, women felt that. I think



# make if we're not careful is r never having to change."

the black students still feel that."

But if you make it through Tech, you don't have to explain anything to anybody. That is the bedrock of the MIT philosophy: You wouldn't be here if you didn't belong here. And you won't graduate unless you've earned it. "More than at any other school, MIT grads wear their brass rats," or class rings, says Harris. "It's a badge of honor."

The institute awards no honorary degrees. The very term is an oxymoron here. Tech does not admit so-called family legacies, and admissions does not check with the development office to see whose father might have given a seven-figure gift. This stance is why MIT recently fought an expensive antitrust battle with the US Justice Department to keep its financial aid need-blind. Because if you deserve to get into MIT, lack of money shouldn't keep you out.

**I**n many ways, Tech is the quintessential American university. Many of its undergraduates are the first from their families to attend college. More than 70 percent come from public schools—more than a quarter of them with graduating classes of fewer than 100 students—and 60 percent get substantial financial aid. "MIT plays a very special role in catapulting kids up from the working class," says Jaffe, the faculty chairman.

Intelligence and hard work matter greatly at Tech, and officials talk about the "egalitarian elitism" that infuses the place. So while Tech wants diversity, it won't yield on merit. Physics is physics, and that will never change at MIT. Tech officials winced last May when *The Wall Street Journal* wrote about a bright black student from a Washington, D.C., high school who attended MIT's summer program for minorities and ended up being denied admission.<sup>4</sup> But they make no apologies for Tech's academic rigor.

The institute has tutoring programs for minority students and a special

office of minority education to help them with their adjustment. But it won't devalue the diploma for anybody. "No one here wants to make this place easier," says Harris. "And the people who will fight the hardest to make sure it remains rigorous are the women and the minority students."

**T**hough the undergraduate student body looks more like America than it ever has, diversity has come slowly to Tech's graduate programs and faculty, which are still predominantly white and male. "Painfully slow," says Vest. "We have a lot of work to do. I do not believe there are simple answers. I have yet to find any silver-bullet solution."

Some Tech officials say it's a pipeline issue—it takes time to create diverse role models. Others say it's more a matter of old-boy networking. Women have been at Tech for 120 years, yet they still comprise only 12 percent of the faculty. In some ways, it still is Karl Compton's MIT. One thing, though, hasn't changed for anyone here. Everybody's still up late.

Tech's mascot is the beaver. It should be the owl. MIT's campus is easily the most nocturnal in America. "You'll be walking around the dorms at 2 a.m., and half the lights are on," says Sarah Keightley, a biology major who's editor-in-chief of the *Tech*, the student newspaper. "All-nighters are pretty common." MIT football coach Dwight Smith once said that he couldn't tell when a player had been up all night. "If he's been up two nights, I'll notice," Smith said.

Most Tech students got here because they worked like demons in high school. They get whacked with mandatory physics, calculus, chemistry, and biology as soon as they walk in the door, and they keep working. Most of them are convinced that the kid next door, the "ghost" whom they never see, is working even harder. So they hunker

down in the Toolbox (the campus library), get a caffeine jolt and a snack at the 24-hour coffeehouse inside the Stratton Student Center, and keep on cranking.

The administration does what it can to vent the steam. Freshman year for all students is graded pass or no credit. The office of undergraduate academic affairs offers a workshop called "Advanced Chilling Out for the Stressed Out." Nightline, a confidential peer-listening phone service ("Is something making you scream?"), offers a sympathetic ear all night. Though myth has it that MIT's suicide rate is the highest in America, institute officials say that it's no higher than the national average for collegians.

"We do value hard work here, but we have to be careful that the pressure is not arbitrarily or unreasonably imposed," says Vest. "I will tell you that much of it is self-imposed. The students here are very competitive, very motivated."

Ironically, the institute's attempts to tone down obsessiveness subtly increase pressure. "It's very easy to be mediocre here," says Carrie Perlman. "Grades are A-B-C, so they give out a huge number of B's. But the grad schools still look for a certain GPA; you must have it."

A century ago, it took only two years to get an engineering degree from MIT. Now, some Tech professors say, maybe it should take five—especially if the engineer wants to take management and finance courses. "The engineering sciences will always be at the core of what we teach here," says Joel Moses, the engineering school dean. "The question is: How much do you need of the other stuff? It's not clear."

The other stuff wasn't a concern in 1865. It is now that J. P. Morgan hires more Tech grads than US Steel does. A new millennium beckons, and the polytechnic school by the Charles strives to remain useful. "When I first came here," says Vest, "we had a two-day retreat



with our top academic people, and we tried to describe how the institute would have to be in the future. The adjective we came up with was 'nimble.' " □

FOOTNOTES: 1. The federal government conducts annual audits of the indirect costs of research, at which time any errors, in either direction, would be totaled up and checks exchanged. The audits for 1986 to 1990, however, were not completed—and the books were not closed—until 1991. In May, 1991, MIT repaid \$778,000 for charges that had been inappropriately billed to indirect costs over the previous five-year period. The sum represented one-fifth of one percent of the \$383 million in indirect costs paid to MIT over that period—on a total federally funded research bill of \$1.36 billion. The "trip to Barbados" involved MIT representatives who were meeting with local authorities, insurance company executives, and lawyers to discuss medical liability insurance for MIT's clinical research facility. Liability insurance, a necessary cost of medical research, is affordable from Caribbean offshore companies, and the only reason that partial reimbursement for the trip was disallowed by federal auditors was that trip organizers had neglected to obtain the required prior approval. The "dinners, flowers, and alcohol," were the costs of official entertainment associated with research, costs which had been routinely allowed under federal auditing regulations during the years under review.

2. Reengineering is a fairly widespread term in the management community, particularly since the 1993 publication of *Reengineering the Corporation*, by James Champy, '63, SM '65, and Michael Hammer, '68, PhD '73.

3. Day to day management of reengineering at MIT is in the office of the vice-president for operations, William Dickson, '56.

4. Cedric Jennings, an outstanding student at what is considered the roughest high school in Washington, D.C., was featured in two articles in the *Wall Street Journal* and on *Nightline* on ABC television between spring and fall, 1994. Much of the coverage focused on his experience in MITES, an MIT summer program to encourage high school juniors to consider careers in engineering and science and to prepare them for a technical education. Jennings had some academic deficiencies, however, and his MITES advisor suggested that he would not likely be accepted as a freshman at MIT, which was a serious disappointment for the young man. He did not apply for admission to MIT, but it is our understanding that he has applied and been accepted at another university for fall 1995. *Technology Review* plans an update on Jennings's situation in a future issue.

## LETTERS

### STUDENT MEMORIES OF WIESNER AS PRESIDENT



I was a freshman at MIT in 1971, and I felt a special kinship with Jerry Wiesner, as it was his first year as president. In the midst of all the turmoil in the world, in this community, and in my own life, I wrote him a passionate, four-page letter—bearing my soul and searching for "truths." I was very surprised to receive in short order a personal, well-articulated response from him, with an invitation to visit him any time.

I took him up on his offer and found him to have all the qualities mentioned in the eloquent tribute in *Technology Review* (January 1995). I have always been grateful for the personal help he gave me in getting through those troubled years. In addition, since graduating from MIT, I have been a public school teacher, happy to be working with students who did not share many of the advantages I experienced. I know that Jerry Wiesner played a large part in my decision to teach.

Thank you for expressing the feelings of many students for that wonderful man.

JON SASS, '75  
Holyoke, Mass.

As a member of the Class of '83, I was in the last group to be welcomed by Jerry Wiesner at the Freshman Picnic. And as a resident of Senior House, I was on hand when he gave a talk that was the highlight of the Housemaster's Lecture Series for my senior year. The talk was held in one of the lounges, with several dozen of us packed in, many sitting on the floor or perched on window sills.

He summarized [the history of disarmament] and theorized about future developments and there was an extensive period of questions and conversation. Two remarks stand out in my mind as painting a portrait of Jerry Wiesner as a man of peace trapped in the days of the Cold War. Someone asked if there was anything he would do differently if he were able to relive his days as science advisor to President John Kennedy. Wiesner replied that when the Atmospheric Test Ban Treaty

was passed, the popular wisdom among disarmament supporters was that they should stop there, rather than jeopardize their gains by pushing for a broader agreement. Given the chance to try again, he said, he would have kept pushing for a Comprehensive Test Ban.

Later in the discussion, I asked him whether, if he had his "finger on the button" and could see unambiguously on a radar screen that Soviet missiles were coming over the pole, he would push the button to launch a retaliatory strike. I'll always remember his answer and what it showed of the dilemma we faced: "Well, no," he replied, "but you can't say that [in public]!"

JEAN-JOSEPH COTE '83  
BOULDER, COLO.

### RECYCLING TECHNOLOGY REVIEW

The city I live in now recycles three kinds of paper: newsprint, glossy magazines, and other mixed paper. However, as with many such programs, it is important that residents sort materials as accurately as possible. One problem is that people often do not know the proper category for a recyclable paper product. In particular, many papers that look like newsprint, such as the pages of phone books, actually cause problems if included in newspaper recycling.

Is the MITnews section of *Technology Review* printed on newsprint or another paper? I suggest a short notice below the table of contents to encourage alumni/ae readers to recycle the magazine where possible and gives them the information they need to recycle properly.

RON READE, '84  
Berkeley, Calif.  
read@lbl.gov

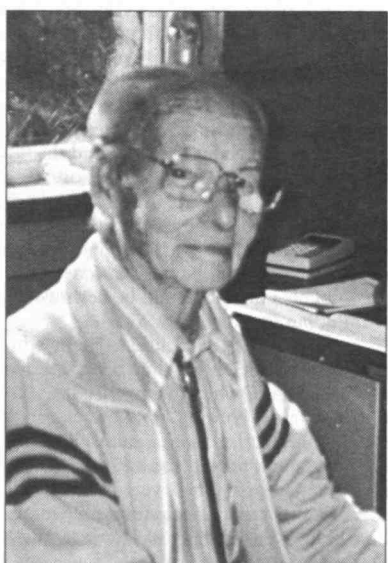
By recycling standards, the MITnews section of *Technology Review* is "ledger paper," technically a higher grade than the coated stock used for the full-color, newsstand section of the magazine and much higher than newsprint. According to the recycled-paper broker consulted by Jennifer Combs, environmental coordinator for MIT, the entire publication can be recycled as a "magazine," or the MIT section can be pulled out and recycled as "white paper."—Ed.



# ClassNotes

**15** We have a letter from Virginia Pick Brunsfeld Polley, wife of Ernest Polley of Denver, Colo., who died last February 16, 1994, a few months short of his 101st birthday.

Virginia writes, "It is high time to let you know that Ernest Polley, Class of 1915, a very special class, a very special man, is deceased. On his 100th birthday we had a big celebration and he greeted over 100 guests who were most interested in a slide show of his life. The MIT years were an important part of that



*Ernest E. Polley, '15, relaxes at his desk a short time before his death at age 100 plus.*

show and it included pictures of him then, and the early buildings, the Delta Tau Delta fraternity, and later work in which he utilized what he had learned at MIT. . . . He enjoyed every minute of it. He was very active almost to the end and loved MIT."

She included a card with some of his favorite words that he found in a park in Johannesburg, South Africa, carved in a rock:

The clock of Life is wound but once  
And no man has the power  
To tell just when the hands will stop  
At late or early hour

Now is the only time you own  
Live-Love-Toil with a will  
Place no faith in tomorrow  
For the clock may then be still.

In addition to Virginia, Mr. Polley is survived by a daughter, a grandson, and two great-grandsons.—ed.

**21** It is one of the happiest times of the year—the pre-Christmas season—as we prepare these notes and helpful cards from our faithful flock are starting to arrive along with welcome wishes from other MIT friends.

To date, Helga Parsons, wife of the late James S. Parsons, engineering administration, has nurtured our vanity with high praise for the 1994 notes; and Emma Lloyd, wife of the late Leon (Al) Lloyd, mechanical engineering, tells us of frequent domestic flying to visit her widespread family.

Emma asked about Helen St. Laurent, wife of the late Raymond A. St. Laurent, chemical engineering, cooperative, and popular class president. With round-the-clock aid, our phone call of holiday greetings disclose, that Helen maintains the same good condition and reports only limited hearing and necessity for a cane in walking.

Sumner Hayward, chemical engineering, our long time secretary-treasurer (now emeritus), happily told of the arrival of a great-grandson to join ranks with his great-granddaughter.

Sumner also told us of the death of Cecelia (Ceil) Huggins, wife of the late Frank E. Huggins, Jr., chemical engineering, cooperative. Frank had been included in the fictitious "4-H Club" of Hawes, Hayward, Hill, and Huggins, of whom only Sumner survives.

Donald P. Severance, '38, former vice-president of the MIT Alumni/ae Association and long a friendly helper in alumni matters, phoned greetings and told us he was calling from his and Phyl's new home in Exeter, N.H.

Your scribe's immediate family also has one new address. Members now reside in Maine, Connecticut, New Jersey, Virginia, and Oregon.

The outstanding letter so far is from our former boss as editor of *Technology Review*, John I. Mattill, Hon., and his lovely wife, Anne, a top-notch artist. The gorgeous work of art recounts experiences of watching exotic birdlife in tropical foreign climes as a setting for holiday greetings.

We still urgently need your news in the friendly Christmas spirit—in long hand, on a postcard, computer typed, or phoned to suit your convenience—to enable us to write these monthly notes.—Carole A. (Cac) Clarke, president and secretary, 608 Union Lane, Brielle, NJ 08730-1423, (908) 526-8881; Samuel E. Lunden, assistant secretary, 6205 Via Colinita, Rancho Palos Verdes, CA 90274, (310) 833-1480

**22** Please send news for this column to: Class Notes Editor, *Technology Review*, MIT W59, 201 Vassar St., Cambridge, MA 02139

**23** I have heard from two of our honorary members. Isabel Skinner says she is "hale and hardy." We received a Christmas card from Phyllis Davenport who states that she is well.

Yours truly is well and drives nearly every day. To navigate to our dining room which is almost one quarter mile away I use an electric cart.

I have one death to report. Sherwood I. Berger passed away on May 1st. His home was in Winchester, Mass.—Royal Sterling, secretary, 2350 Indian Creek Blvd. W., D-201, Vero Beach, FL 32966

**24** Please send news for this column to: Co-secretaries: Katty Hereford, 237 Hacienda Carmel, Carmel, CA 93923; Colonel L. Henry Stern, 2840 S. Ocean, #514, Palm Beach, FL 33480

## **25** 70th Reunion

The Technology Day program of the Cardinal and Gray Society will reach you soon.

Since some of the 70th Reunion events will be in conjunction with the Cardinal and Gray Society, you should tell the society what events you plan to attend and make reservations.

A card from Mrs. Garvin Drew, Lil, reports that she was quite ill last spring but is much better. She still drives. Mrs. Ed Kussmaul, Adele, notes that she still spends winters at Briny Breezes in Boynton Beach, Fla., but returns to New Hampshire for the summer.

A phone call from Donaldson Jones led to discussion about the number in the graduating Class of 1925. He felt it must have been larger than the 400 plus usually quoted. The source of this figure is the *Technology Review*, which reported on the graduation of the total degrees awarded (584), advanced degrees numbered 128, and 456 received bachelor's degrees.—F. Leroy "Doc" Foster, secretary, 434 Old Comers Rd., P.O. Box 331, North Chatham, MA 02650

**26** Classmate Walter E. Lobo has notified us that he heard from Ruth, the wife of Walter Sargent Graves, that he died on May 13, 1994. Lobo noted that Graves had worked for him for a number of years before going out to Richland, Wash., where he worked in the atomic energy plant. They had lived there ever since they had been married, almost 64 years.



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Walter E. Lobo also noted that his companions at home are "loving and lovable golden retrievers"; also that he's had three operations this year for a non-malignant tumor.

**Harold J. Ryan** of Kings Park, N.Y., died August 8, 1994. He had been an air conditioning engineer who worked on the Waldorf Astoria Hotel, the Pan American Building, the New York City subway system, and the Statue of Liberty, among other projects. He worked as a supervising engineer for Frigidaire until 1939 and then started his own engineering and contracting company. He remained president of Harold J. Ryan, Inc. until 1954. He was the author of important articles for the industry. He loved boating and was a member of the United States Power Squadron. He is survived by his wife of 62 years, Marcetta, four daughters, a son, 25 grandchildren, and two great grandchildren.

**Frazier P. LaBoon** of McLean, Va., died June 6, 1994. No other information accompanied the notice.

Please send news to: **Donald S. Cunningham**, secretary, c/o Ronald F. Frazier, 132 Middle St., Braintree, MA 02184

# 27

**Charles W. Dinan** of Nutley, N.J., died June 28, 1994. His wife, Alice, wrote, "For 30 odd years, he was in middle management at the Koppers Co. of Pittsburgh at its

Kearny, N.J. plant." He attended our 50th and 60th reunions and was very interesting to talk with. Besides his wife, he is survived by two sons, Charles W. Jr. and Dr. John E. Dinan.

**Gordon W. Calderwood** of Rochester, N.Y., died on July 10, 1994, of heart failure. He was one of the triumvirate of boys from Springfield High who joined MIT with the late **Richard Cheney** and Class President **Harold Fisher**. With an SB in chemical engineering and an SM in fuel and gas, he worked for Rochester Gas and Electric for 41 years—first at the old "gas works" and later at the main office. He retired in 1970 as director of safety. His interest in safety continued after retirement as he served on the Safety Council of the Rochester Chamber of Commerce and the Occupational Safety Section of the Industrial Management Council.

Long before the civil rights movement, Gordon was concerned with providing opportunities for minority youths. He and his wife Lucie were active in the resettlement of refugee families in Rochester as well as hosts for visitors from all over the world. Far beyond helping with initial problems, they became surrogate grandparents to a host of young immigrants from Asia, helping them with everything from dealing with government red tape to finding prenatal care for an expectant mother. In 1983, the Rochester Association for the United Nations recognized them for their efforts on behalf of international understanding. He also served as a member of the board of directors of the Montgomery Neighborhood Center for 25 years.

In retirement, he volunteered his engineering skills and technical assistance to several charitable enterprises including a trip to the mountains of Colombia with his wife in 1979. He was a member of the Astronomy Section of the Rochester Academy of Sciences and the Burroughs Audubon Society. He played the cello with the Brighton Symphony and was an

amateur landscape painter.

His daughter, Nancy, wrote some beautiful lines for his service. Here is an excerpt: "Many people in this community knew Gordon as a thoughtful friend, a ready helper in any project that could replace human despair with opportunity for growth, and witnessed his devotion to his wife, Lucie. I would like to share with you a different side of him, the loving father and matchless teacher."

"His love was so unconditional and so strongly felt that to disappoint his expectations would have been unthinkable. Despite the physical and intellectual demands of his work, the long hours and weekends on call, he managed to include his daughter in his activities when he was home."

"How many children have been awakened at dawn by their father to witness together a perfect sunrise, or a conjunction of planets with the moon, or gotten up in the middle of the night to watch in awe a meteor shower, or a lunar eclipse, or to view through a telescope the moons orbiting planet Jupiter?"

"I'm sure he never intended to raise his daughter to be a feminist, but what else could be the result of his patient and constant insistence that I could figure out the answers to my own questions, that I could indeed solve my own homework problems myself? I remember some painful evenings with frustrating homework at the dining room table when I could feel my brain stretching as I struggled through the prescribed steps to reach a solution. He never lost patience and never let me doubt my own intelligence. This gift of self-awareness—the ability to realistically assess one's strengths, limitations, and possibilities—was one of the most valuable gifts that could be bestowed on any child, but invaluable for a girl."

"I was introduced as a child to many educated black people before they became leaders in the community when they were guests at our dinner table. For my father, no external physical characteristics or circumstance had any bearing on a person's value, only what kind of human being they were inside."

Gordon was certainly a remarkable man to fill his life with a diversity of interests. We extend our sympathy to his wife, Lucie, and to their family.

**Fordyce Coburn** of Pueblo, Colo., died on August 21, 1994. He retired as director of purchases at C F & I Steel Corp. following 42 years of service in the iron and steel industry in Illinois, Pennsylvania, and Colorado. Among many memberships, he was honorary board member of the Parkview Episcopal Hospital Foundation, the Newcomen Society in North America, the Iron and Steel Institute, and the Society of the American Institute of Mining, Metallurgical, and Petroleum Engineers. He was also a member of the MIT Alumni/ae Association of Colorado. Fordyce is survived by four children, eleven grandchildren and 3 great grandchildren.—**Joseph C. Burley**, secretary, 1 Harbourside Dr., Delray Beach, FL 33483; **Lawrence B. Grew**, 21 Yowago Ave., Branford, CT 06405

# 28

I regret that as of this writing there is little regarding our normally age-resistant class membership except the following deaths. However, some of the reports have been delayed, so we



may be maintaining a more reasonable average.

In Honolulu, Hawaii, on December 20, 1993, **Paul Anderson Johnson**. Paul was from those islands and worked there all his life except for a few years after graduation when he worked for General Electric.

In Grosse Point, Mich., on January 24, 1992, **Robert Gray Kales**. Bob attended Harvard Business School after MIT and was active in business, civic, and military affairs throughout his life.

In Marstons Mills, Mass., on October 2, 1994, **Alfred Conway Knight**. Alfred attended Boston College Law School after MIT and remained in the legal profession throughout his life, including in combat military service in WWII. In later years, he was a country lawyer and judge in Cape Cod.

In Chatham, Mass., on September 13, 1994, **Franklin Cushing McCoy**. Franklin was active in radio and electronics work.

In Hayward, Calif., on October 23, 1994, **Ngeu Faung Tsang**. Professor Tsang came to MIT from China, received degrees from Cornell and MIT, and was engaged in engineering and teaching in China. He returned to the U.S. after WWII and taught at universities in Minnesota, Louisiana, Mississippi, and Arkansas before retiring in California.

In Center Harbor, N.H., on April 4, 1994, **Roger Walker Haven**. Roger was an industrial engineer. He worked on jet engine and supercharger engineering with General Electric in WWII. He was a sailing enthusiast who especially enjoyed building and sailing ice boats. We send our condolences to friends and family of our classmates.—**Ernest H. Knight**, secretary, 168 Ai Plummer Rd., Raymond, ME 04071-6349

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We are delighted to receive a letter from **Norman M. Wickstrand**, as follows: "Some months ago, I wrote a short history of the town of Stratton, Vt. Among the references

was *Turnpikes of New England* by Frederick J. Wood. The interesting part about this is that the author dedicated the book to three of his MIT classmates of 1888. They included Charles A. Stone and Edwin S. Webster, who formed Stone and Webster, the general contractor, I believe, for MIT's original buildings in Cambridge.

"My wife is in a convalescent home here, and I am in a non-nursing part of the same facility. I think that I can easily say that I am in fairly good health for an 89-year-old."

We have seven class deaths to report: **Leon Avalos Vez** of Mexico in 1992; **Daniel T. Foley**, retired colonel, Fall River, Mass., on November 6, 1994; **Jerome Franks** of Cincinnati, Ohio, April 3, 1994; **Joaquin J. Llanso**, The Woodlands, Tex., November 30, 1994; **Charles R. Oleson**, Marietta, Ga., October 10, 1994; **Murice O. Porter**, New York City, in 1994; and **Louis F. Southerland, Jr.**, Austin, Tex., September 11, 1994.

**Jose L. Avalos** writes about his father: "He was always very proud of having graduated from MIT. He loved his school. Thank you for all these years of bringing to him great memories." ... **Jaime Llanso** sent a newsclipping about his brother. Originally from the Philippines, **Joaquin Llanso** studied mechanical and marine engineering at MIT. After graduating

from MIT, he joined Worthington Corp., eventually becoming part of their international marketing organization. He traveled extensively and for many years resided in Buenos Aires, Argentina, and Lima, Peru. Upon leaving Worthington, he joined Knight International Corp., rising to the position of president and CEO. In later years he undertook a series of international marketing consulting projects. He is survived by his wife of 62 years, **Dorothy A. Llanso**. ... Before retiring, **Charles Oleson** worked for Niagara Mohawk Power Corp., as manager of engineering for central New York. His wife, **Mabel**, survives him.—*ed*. Please send news for this column to: Class Notes Editor, *Technology Review*, MIT, W59-217, 201 Vassar St., Cambridge, MA 02139.

## 30 65th Reunion

As you know, the first mailing about our 65th reunion went out early in December. The

return postcards have been trickling in for the past 10 days. As of mid-December we have received 62 responses (about a third of those mailed). There have been seven unqualified "yeses": **Herbert, Latham, Lister, Marean, Savina, Thormin, and Wilson**, as well as 17 "maybes." Historically the average attendance at 65th reunions has been 17. Hence, if three-fourths of our "maybes" get to Cambridge, we will reach this average. Hopefully we will do better than this when final decisions have been made. We expect detailed information about program and costs to be mailed about the time these Notes are published.

Our oldest survivor, 94-year-old **Joe Kania**, and his wife, **Florence**, of Vancouver, B.C., are inveterate travelers. During the past year their trips have included a flight to New Orleans and cruise on the *M.S. Noordam* through the Panama Canal and back to Vancouver, a four-day "Rocky Mountain trip to Jasper, and a 20-day U.S. bus trip that took them as far east as Nashville, Tenn." ... **Vince Thormin** of Calgary, Alberta, is another senior traveler. His travels during the past year took him to Chichen Itza, Yucatan, and on a cruise from Rome to Athens with stops at Capri and several Greek islands. Vince is one of our three classmates who became clergymen, and he still visits church people who are in hospitals and nursing homes. In early November he reported that members of his family, including a granddaughter who lives in Tokyo, would be coming to Calgary at Christmas time to help him celebrate his 90th birthday. He has relatives in the Boston area and presently plans to combine a visit with them and attendance at the 65th reunion. (Note that both **Kania** and **Thormin** live in Canada. Does this tell us something?).

**Alfred G. Ennis** died February 6, 1994. I have never received a direct report from him, but from secondary sources it appears that he received an SM in electrical engineering from MIT in 1930. He seems to have spent much of his career working for Johns Hopkins University, particularly at the Applied Physics Laboratory in Silver Spring, Md., and retired in the early 1970s. He was living in McLean, Va., at the time of his death.—**Gordon K. Lister**, secretary, Apt. 40, 5707 Williamsburg Landing Dr., Williamsburg, VA 23185

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Jay T. Westermeier  
Mitchell Zimmerman



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Please send news for this column to:  
**Wyman P. Boynton**, secretary  
 668 Middle St.  
 Portsmouth, NH 03801

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In view of the small response to the proposed April mini-reunion in Hawaii, it was decided the class should not sponsor the event, but **Manley St. Dennis** and his wife, **Sarri-**

**na**, wish to take responsibility for the reunion no matter how many classmates go. They promise a good time for all who come. . . . I have received holiday greetings from **Rose** and **Tom Weston** with a letter describing their activities for 1994. In spite of bouts with ill-health, they maintain a busy schedule of activities that would do justice for any half their age. Congratulations to you, **Tom** and **Rose**, we all hope this coming year will hold many interesting events for you and yours. Continue to keep us informed. . . . **Carl Waalstrom** had a stroke on his 86th birthday April 26, 1994, and is now in a wheelchair. He sends his best wishes to his classmates.

We have news that **Albert Ward Dunning** died on November 14, 1994. He was 86 years old and married to **Lois Thompson Dunning** for 52 years. Born in **Newton, Mass.**, he was the son of missionary parents, and he spent the first 10 years of his life in **Kyoto** and **Kobe, Japan**. On April 16, 1934, he was featured on the front page of the *New York Times* for being the first pilot ever to be rescued at sea with a rubber life raft dropped

from another plane. Due to engine failure, his plane dove into the water and sank, leaving him afloat for over two hours in the Pacific Ocean. His rescue was considered a remarkable feat at the time. He served as a pilot sales engineer for **Monsanto Chemical Company** until the outbreak of WWII. He then served in the **Bureau of Aeronautics** in **Washington, D.C.**, and in the **Aviation Supply Office** in **North Philadelphia**, supplying spare parts for airplanes in the **Pacific Theatre**. He retired from the **Naval Reserve** as a commander. Following the war he returned to the plastics division of **Monsanto** as a sales manager and later moved to **Tokyo, Japan**, as a VP and director of **Mitsubishi Monsanto**. After returning to the **United States** he became director of marketing for the **Shawinigan Corp.** and later VP of the **Plastic Coating Corp.** in **Holyoke, Mass.** In retirement he established his own company, **Dunning Associates, Inc.**, where he designed, built, and operated equipment used in the electrostatic process of dry powder coatings. He is survived by his wife, two daughters, and a son.

Our classmate **John Zouck** died July 13, 1994, at 83. In recent years, he and family members bred, trained, and raced a small stable of thoroughbred horses. He helped to develop a process for continuously coating wire and had been associated with several wire companies after starting his career as a steel worker for the **Bethlehem Steel Corp.** He joined the **Marine Corps** during WWII and commanded the maintenance depot of an air unit in the fight for **Guadalcanal**. During this time, he worked with aviation pioneer **Charles A. Lindbergh** to increase bomb loads for the

planes and make other technological improvements in their fighting abilities. He was discharged as a lieutenant colonel. He is survived by his wife of 56 years, three daughters, and a grandson.

**Alexander Chaplik**, 89, died on June 19, 1994, of heart failure. Born in **Lithuania**, he came to America when he was 14 years old. In WWII, he served with the Navy as a lieutenant commander. After the war, he worked as a procurement officer for the Air Force until his retirement in 1965. He also had been an employee at the **Gillette Co.** plant in **South Boston**. He was a member of numerous **Lithuanian-American** civic organizations, including the **Knights of Lithuania** and the **Lithuanian Alliance of America**. He leaves his wife, **Eleanora**.

**Mrs. Dan Kentro** (**Katherine**) informs us that **Dan** died August 13, 1994, after six months of miserable illness. **Dan** was manager of several chemical and mining companies, including **American Cyanamid** and **Unocal Inc.** He is survived by his wife and two sons.

On behalf of all the officers of the Class of 1932, I want to extend to all you classmates, near and far, best wishes for a happy holiday and a good and healthy New Year. Please write.—**Melvin Castleman**, secretary, 163 Beach Bluff Ave., Swampscott, MA 01907

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Celebrating one year before their golden wedding anniversary, **Dorothy** and **Wilber Huston** and 30 others of the **Huston class** will find themselves aboard the **Bahama-**

#### ANNOUNCING THE

### KATHARINE DEXTER McCORMICK '04 SOCIETY

The McCormick Society was established to honor one of MIT's greatest benefactors and to recognize and thank donors who give to MIT through life income fund gifts, outright bequests and other deferred gifts.

**Katharine McCormick** gave to MIT in gratitude for her scientific education, which, she stated, was of inestimable value to her throughout her life. Like this generous alumna, the members of the McCormick Society enable MIT to plan for the future with confidence and strength.

*If you are interested in supporting MIT in this vital way or if you have already done so, please let us know. Write or call:*

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bound *Olympic* on a certain day in 1996. The four-day cruise promises the adults aboard almost complete escape from looking after little kids, which Wilber says the Hustons are blessed with. The question is, How will they outdo this premature celebration when the real day and year arrive? . . . **Edward R. Atkinson and Leonard Julian** both sent me copies of Robert Campbell's review in the *Boston Globe* of the MIT Museum show, "From Louis Sullivan to SOM: Boston Grads Go to Chicago." Campbell says the theme of the show was convincing enough, but it paled before the power of some 15,000 drawings, mostly student work, that piled up in the MIT archives between 1840 and 1968. Although Campbell notes that the climax of the show was a 12' tall *Beacon of Progress* inspired by MIT professor Desire Despresdelle's visit to the Columbian Exposition of 1893 in Chicago, he also says that two student drawings by **Gordon Bunshaft** reveal the radical transformation that took place at MIT in the 1930s: Although as freshmen we were in the classic analytique mode, in our second year we applied Mayan and other influences to stray from the shadow of L'Ecole des Beaux Arts, and by our fourth year at MIT, we were full-blown insurgents on the way to redefining architectural form.

St. Stephen's Episcopal School in Austin Tex., recently named a dormitory, the *Marshall House*, in honor of **Courtenay D. Marshall** and his late wife, Ima. Court has two sons, a daughter, and a grandchild, and he sends these brief biographical notes: After graduation, Court could find no job in the east so he hitch-hiked to the Gulf coast and found a job with a large refinery. While there, he took his reserve commission in the Army, but when WWII started, he says he did not know his left foot from his right. The Army found work that he could do, and after the war he worked for others until 1958, when he went out on his own to make some money. His notes end at that point, so you see what a modest guy he is. Courtenay enjoys going to reunions and seeing classmates such as **Werner Bachli**, whom he meets at the several reunions he has attended; I met Court on a return bus trip to Danvers from Salem during our 60th Reunion. . . . **Doris and Leonard Julian** send their 1994 end-of-the-year compilation of events far and near. They spent much of five weeks early in the year at Palm Beach, then they parted sometime later when Doris and her two sisters took off for a bridge tournament in Bermuda, where they have competed more than a dozen times. Left home alone, Leonard kept the homefires and trophies bright. . . . Memories of my boyhood came to me with a letter from **Meyer J. Schnitzler**. In response to my report of **Benjamin Liberfarb's** passing, mentioning that Ben grew up in Roxbury and that I too had resided there through my school years at MIT, Schnitzler provided me with a hand-drawn map showing his home in Roxbury not two blocks distant from mine. Although he and Liberfarb both attended English High School they did not graduate together, since Schnitzler had to put off MIT for one year before they entered MIT together in 1928. "Schnitz" (as he signs his letter), Ben, and I might have gone through the same gradeschools and we might have been at Putnam or Roosevelt Junior High without anyone of us knowing that we would be destined to

meet one another at MIT.

I regret to report the passing of **Richard E. Poynt** on October 8, 1994. His son, John writes that his father was always proud of being an MIT engineer, beginning his lifelong career in civil engineering in Course I. At MIT, Richard lived in Dorchester, Mass. (a neighbor community to Roxbury most known to us Roxbury kids for its Franklin Park) and went through English High School at about the same time as Ben Liberfarb and Meyer Schnitzler. Richard married Emma Church in 1935, near the start of his 30-year career with the Army Corps of Engineers, where he served as a captain through WWII. Most of the Army construction projects were in the New England area, some on military sites in Kansas and Arizona, and various facilities at Cape Kennedy, Fla. After retiring from government work, he became involved with construction at the National Accelerator Laboratory in Batavia, Ill. The surviving members of the family are his wife, Emma, his sister, a granddaughter, and son John.

In closing, I wish to state some facts so you may draw your own conclusion as to what should be done to memorialize our Class of 1933. When our much-loved classmate **Ferd Johnson** passed on, his wife, Alice Butler Done, attempted to find out from the MIT Treasurer's Office as to how memorial gifts could be directed in "a way that credits his Class." An answering letter in my hands says, "Since there is no Class of '33 fund . . . I suggest Number 40148—the general unrestricted memorial gift account with credit picked up for the Class of 1933 by a Memorial Funds sequence number." Perhaps a fund in the name of the Class of 1933 at MIT ought to be established for memorial gifts. . . . One final word: I have been advised to be cautious in releasing birthdays, home addresses, or projected vacation time away from home and any other personal material that may put you at risk when used by others. But do take time off until we meet again at the Cambridge campus next June.—**Berj Tashjian**, secretary, 1245 Briarwood Ln., Northbrook, IL 60062-4556

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Letters from **Hank Backenstoss** and his wife, Nicki, bring examples of two retirement careers. They have dedicated their lives to making Reading, Pa., a better place to live. Nicki has been active with the Reading Musical Foundation for the past 25 years, particularly with its Star Series, which originally presented national musical virtuosos or orchestras. As the classics were fading in popularity, Nicki stepped in and reorganized the programs to offer programs that alternated classical and popular music. This was a great success, and now they have added children's concerts, country music, and sometimes theater. Nicki's job is to select the programs, which means listening to CDs, radio, and TV specials, acquaintanceship with agents, striking deals and prices, securing theaters, marketing, publicity, and supervising the aesthetics of the stage. The result: total exhaustion offset by the exhilaration of events playing to full houses. Nicki has had a lifetime of volunteerism, starting with the 11 years she and Hank spent in the Middle East at the American University. She ends her letter, "Never a dull moment!"

# ClassNotes

Meanwhile, in 1986, Hank joined the board of the Foundation for the Reading Public Museum, with an assignment to raise funds for the Reading Museum and Art Gallery, and now he is Chairman of the Board. Hank writes, "The museum started in the classroom of a very unusual science teacher in about 1904. He thought teaching with objects was much more effective than solely using text books. The museum grew, soon was the beneficiary of important art collections, and in 1928, was housed in its own very fine limestone building. The museum has great collections in natural history, Native American, Egyptian, Asian, mineral, butterfly, and many other areas. The butterfly collection is world class. Then there is also a superb fine art collection, including works by Degas, Sargeant, Church, and others. Our director calls it a 'mini-Smithsonian' and rates it as the best museum between Philadelphia and Pittsburgh. The welcome mat is out for any classmates who are in the vicinity of Reading or wish to make a special trip here."

A sculpture by **Art Miller's** widow, Rose, of Eleanor Roosevelt it receiving national attention. Rose, who has been a faithful attendant of our reunions, had a retrospective exhibition at the Massachusetts College of Art named "Roots, Routes, en Route," showing sculpture and prints done over the past 30 years. One of the pieces in the show, a larger-than-life bronze of Eleanor Roosevelt, was removed a week after the opening in order to be sent to the newly named Eleanor Roosevelt College of the University of California/San Diego. The United Nations Association and a private individual donated the bust to the College. **Hillary Rodham Clinton** agreed to be the keynote speaker at the dedication. **Doris Kearns Goodwin**, most recent biographer of Mrs. Roosevelt, planned to speak and unveil the sculpture. . . . Met **Lou Frank's** widow, Frankie Frank, at a luncheon recently. She commented that the 60th Reunion was the best ever! She is a consultant to three nursing homes, and works with local families and physicians to ensure proper placement of individuals in nursing homes that best suit their needs.

The Alumni/ae Office advises us that **Warren Bjorn** of Columbia, S.C., died in November 1986. We have no word of a surviving family. Also, **John Brinkley, Sr.**, of Deerfield, N.H., died on March 9, 1994. Again, we have no information on any remaining family. Both Warren and John received their degrees in architecture. We offer our sincerest sympathy to any family members. . . . **Rudolph Gonzalez Garza** died in August 1994. Rudy had been export manager of Vitro, S.A., a group of 12 glass manufacturers, for over 25 years. He was the founder and first president of the Export Association of Monterrey, and was a member of the board of Banpais, a leading banking institution in Mexico. He is survived by his wife, Lydia, four sons, and many grandchildren. We extend our sympathy to them all.

A note from **Bill Ball**: "I was sorry that Lois and I had to miss the reunion. Her health remains the same but a last-minute no-show by the lady who was to stay with her prevent-



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ed my trip to Cambridge with Helen and Earl Lockhart. We were delighted to have Annette and Ed Asch here overnight on their way to the reunion." Bill asked which classmates still live on the Cape. In addition to Earl, there are five others: Herman Ausin, Doug MacMillan, Robert Price, Sam Prince, and Charles Sanders. We would like to hear from or about all of them.—Carl H. Wilson, secretary, 48 Druid Hill Rd., Newton Highlands, MA 02161

## 35 60th Reunion

Morton I. Weinberg writes from his home in Lockport, N.Y., that several names appearing in the January 1995 issue of the *Review* jolted him into the reality that time really is passing. He has several "tiny snapshots" including one taken in the engine design class with Don Gittens and Professor C.F. Taylor, '29. Morton entered MIT with the class of 1934, dropped out after the second year and returned as a member of '35. He said the Army wouldn't let him fly their airplanes in WWII (he wore glasses) even though he'd been licensed as a pilot since 1938. He continued what he was doing at the time—structural design and analysis at the Curtiss Airplane Division. He says, "Bounced around in airborne weapons design and research until 1963 when I was 'busted' to 'traffic cop'. I've been on the ground ever since." He continues, "Literally, I've been working with law enforcement agencies in investigation, reconstruction and analysis of highway accidents, teaching both the police and the district attorneys along the way." At 83 and still flying, Susie, his wife of 54 years, claims it's good therapy for him.

Walter "Stocky" Stockmayer sent a card with greetings "from one of our favorite cities, Freiburg, Germany. This short trip to Zermatt, Strassbourg, and Freiburg was one of Sylvia's birthday presents. Her fibromyalgia causes constant pain, but we've had some good times." . . . Lester A. Brooks writes from his home in Rockmart, Ga., reporting on his and Ellen's life. He is doing a lot of painting and fixing at his home. "We've gotta get out of here," he says. He has a bunch of new chores such as vacuuming carpets, sweeping leaves off the steps, and cutting up butternut squash since arthritis has "wracked" Ellen. However they are looking forward to a week's trip to Barbados in mid-December. He's learned that this is the place where lobbyists send their favorite Congressmen and that there are a couple of golf courses he may try. There's always a bright side. . . . W. Whitney Stueck left a message on my machine last night so I called him back this evening. He phoned from his home in Satellite, Fla. He moved there five years ago from Old Saybrook, Conn. In 1947, he established his own manufacturing business in Essex, Conn. He also set up a branch operation in Utah which his older son managed since 1969. His wife of 50 years, Philena, died three years ago. He is very proud of a one-year-old great-granddaughter, three granddaughters, and one grandson. Whit's youngest son is on the faculty of the University of Georgia. During the last two summers he sailed his 40-foot Swedish boat with a crew of

two to Connecticut and back. If all goes well he plans to sail up to be in the area for our 60th Reunion. He says he can get a crew to sail north but will need to recruit two to help him sail home as he has a back problem. Despite that problem, he hopes to be in shape to row in the 4 if not an 8 this June.

I am sorry to report the deaths of three of our '35ers: Walter Godchaux, Lester S. Lappin, and Donald B. Wood. Walter died on June 18, 1994 in his home town of Slidell, La. He was in charge of production for Godchaux Sugars for many years and later became president of Nadustco, Inc. He was a member of the local chapter of the American Institute of Chemical Engineers. He earned an SB in Course X. He is survived by his wife, Ina Levinsohn Steinberg; a son, Walter Godchaux III; a daughter, Barbara Bailey; and three grandchildren. Lester Lappin died on October 21, 1994, in Miami, Fla. He was a Course VI-C man who worked most of his life at RCA in Gibbsboro, N.J. He is survived by his wife of 53 years, Marion Cohen; three sons, Mark, Fred, and Richard; five grandchildren; two brothers, Arthur and Paul, and a sister, Pauline. Donald B. Wood died October 31, 1994, in Wimberly, Tex. He received his degree in Course XIII-C and was employed by Reynolds Metals Co., Corpus Christi, Tex. He retired in 1979 as a VP of Reynolds Subsidiary in charge of bulk cargo movement on inland waterways. He is survived by his wife of 40 years, Nelle, and four daughters. I am sending our condolences to the surviving family members of our three classmates. It will be only 60 days away from our 60th Reunion when you read this. Be sure you have sent in your registration, we want to see you there. Phone your class friends to be sure they are coming.—Allan Q. Mowatt, secretary, 715 N. Broadway, Apt. #257, Escondido, CA 92025, (619) 432-6446

## 36

On a Thanksgiving trip to see daughter, Kathleen, in Nashua, N.H., assistant secretary Pat Patterson talked with Bryant Fowler. He was

Course II and is on page 45 of *Technique*, but he did not finish senior year being a financial casualty (about 10 percent of our freshman class?). Bryant got a paying job at Tech, from there went to Simplex Wire and GE-Lynn, and made his career from 1943 to 1977 with Raytheon in Waltham, Mass. He has been a "middle road" jazz fan since his student days and his record collections range from 78s to CDs. His recent health is only fair—chronic diabetes and pneumonia last Spring—but he is up and about. . . . Pat returned to his Pleasantville church choir in December with other old-timers to sing parts of "The Messiah." . . . A card dated November 5 from class president, Alice Kimball in Brazil notes: "The eclipse this morning lived up to expectations. Rio was most interesting and Iquacu Falls is wonderful."

Virginia and Dick Denton stopped in Santa Fe as they drove a southern route back to New Jersey from the American Vacuum Society meeting in Denver, Colo. In the "mile high city," Dick jogged and walked the AVS five-trillion-nanometer run in about 45 minutes. "Close to last place but I am always the oldest so my handicapped times are not so bad," he says.



From a survey of our quiet classmates: **Tom Nelligan** (Course IX-B) was with Ford and DuPont after an MBA from Harvard. He then became executive VP of Albert Schwill & Co. and retired as president of Pokorney Manufacturing. Tom and his wife, Patricia, see Vivian and **Mal Holcombe** when the Holcombes are using their condo at Hilton Head. . . . **Bill Reilly** (Course III) bought up three companies making industrial protective clothing (police, fire, you-name it) and operated them as Sawyer-Tower Products until he sold the firm in 1975. He later established a publishing business that releases first chapters on the Internet for prospective buyers. He is into computer learning, rides a bike for exercise, and he and wife, Joan, "have had a ball." His e-mail address is <war@world.std.com>.

**F. David Mathias** came from Ashbury College to Course IV and, except for four years in the Canadian Army, practiced architecture in Montreal. He hears from John Allen (also Course IV) regularly, and recalls fellow Theta Xi's **Fred Assmann**, **Charles "Mal" Graves**, and **Bob Van Patten-Steiger**, a fellow varsity hockey player. In October, David and wife, Nancy, celebrated their 55th anniversary in the home they built in 1948. . . . **Ernest Murray** (Course XVI), yet another financial casualty, later took courses in business administration at BU and studied at Westlawn School of Yacht Design. His career in nautical design and production included air-sea rescue and landing craft for WWII, non-magnetic diesel engines for minesweepers in the Korean War, and marine and industrial applications of engines in peace time. He worked for Packard Motor, Curtis-Wright and Cummins. With Cummins he became manager of the southwest region. In a year and one-half at Tech while living at Kappa Sigma, he developed lasting friendships in the class. He mentioned those still living—**Ben Fogler**, **Bus Schliemann**, and **Bernie Vonnegut** "who did cloud seeing experiments with GE."

Traute and **Ken Winsor** went back to Italy in November to close on the home they finally sold. "Not a great sale but in a widespread bad market, about all that we could expect." They could not bring their dog to Florida, but the pet and its new owner are links for anticipated annual visits. Traute is German and has a green card until naturalization is complete. She loves the U.S., and from our brief conversations over the years, I think we will all welcome her company in June 1996. Ken is exercising regularly for our crew. . . . *First alert* to all oarsmen: In about 14 months we will assemble at the boathouse for a hoped-for rowing eight, perhaps the first ever at a 60th reunion. We will miss **Milner Wallace**, and there may be one or two somewhat disabled. But we should have **Rob Wead** from Maui and **Bill Nichols**, whose experience was unknown to me earlier (are there any others?). So please stay in shape—daily vigorous walking is great.

Cheers for the lives of **C. Wheeler Coberly** and **F. Philips Pike**, both Course X-A and correspondents with Bill Rousseau's Practice School group. "Cobe" died May 17, 1993. For our 25th reunion, he wrote of flying his Beechcraft Bonanza about 250 hours per year on business as officer and director of Coberly and Plumb (agricultural chemicals) and of "assisting in any effort to decrease government spending." Philips Pike was professor emeritus of chemical engineering at University of South

Carolina. A hardy soul—against a doctor's diagnosis that he would lose a leg after an animal bite in 1986, he recovered fully. . . . The last line printed in the November Classnotes was: "Would that we could all die with such dignity and grace,"\* but "Will that we can" better expresses the sentiment. Almost invariably, I find classmates upbeat despite a variety of problems. Glory to all of you!—**Frank L. Phillips**, secretary, 1105 Calle Catalina, Santa Fe, NM 87501, (505) 988-2745; **James F. Patterson**, assistant secretary, 170 Broadway, Pleasantville, NY 10570, (914) 769-4171

# 37

The big news in Meadville, Pa., last year was the renaming and dedication of the **George S. DeArment Ice Arena** as part of the Meadville Area Recreation Complex.

George was also honored for his leadership in establishing the complex about 20 years ago, which now contains three swimming pools and the ice skating rink. George has been active as a charter member of the Recreation Authority, even while he was president and now co-chairman of Channellock, Inc., in Meadville.

*The Herald* of Randolph, Vt., tells a fascinating story of the roles **John Nugent** played in the U.S. space program, especially in the development of the guidance systems that enabled the lunar module to land on the moon. Twenty-five years ago, he was the assistant director for mechanical design of the inertial reference system. John says, more modestly, I was a "nuts and bolts man." He worked for the Instrumentation Lab (now the Charles S. Draper Lab of MIT). John says that the Lab was the first member of the Apollo team to be appointed by NASA because "this was the lab that knew how to get from here to there." Nice job, John, now we know what you were doing with those funny hats.

From **Chester Kyih-z Nie** in China came plaudits to **Bob Thorson** for recovering from his heart problem. He points out that he and his wife, Virginia, have had coronary disease problems for years and "have had to keep at ease for years with as little social activities as possible."

Another class member, **Joe Smedile**, and his wife, Martha, found their social life limited when he wrote from Florida during the tropical storm Gordon. "We have had heavy rains and strong winds for about five days. We have lost several roof tiles but have not had any roof leaks. Hallelujah! A number of limbs broke off our trees and the yard is covered with leaves and small limbs. This part of Florida has had many of its streets flooded and made nearly impassible. Some schools have been closed and we have had several power outages."

From Colville, Wash., **Charles W. Dodge** has had sadder problems. He writes, "My wife, Eleanor, has Alzheimer's disease and is in a nursing home. I live in a new mobile home in NE Washington where I am near my daughter and son-in-law. I spend much of my time improving my proficiency on a computer, writing letters, keeping my personal finances on spreadsheets, and writing Biblically-oriented articles."

**Duane O. Wood**, former president of Lockheed California Co., and now president of

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CLN Consulting Corp., writes that he is still doing some consulting work. "Most of it relates to the selling of Westinghouse's new non-rigid airships. This year, combining business with pleasure, I went to Athens, where I visited the Hellenic Aerospace Industries. I had been instrumental in starting it when I was with Lockheed, and found some of the same people managing it. Then came a pleasurable trip, a cruise through the Greek Islands to Istanbul. Then more business, the Farnborough Air Show near London; and finally a week in Venice. At home I spend time with my family including two grandchildren, one in Washington, D.C., and one in Santa Barbara. Alone at home I play with my long-time hobby Hi-Fi."

Do you like cranberries? Ed Bartholomew does. Since retiring as professor of metallurgy at U.Conn., he has become president of the Phoenix Cranberry Corp., controlling 63 acres of cranberry bogs in Wareham, Carver, and Plymouth. His berries become part of the "Ocean Spray" output. He combines this with boating, fishing, and woodcutting. But hold up. This is only for mid-May to mid-January. The rest of the year he spends in his townhouse in Tucson, Ariz., where swimming and hiking take over. In all of this, his family partakes—his wife, Sara, two sons, and two daughters, along with seven grandchildren. And, if you are interested, he says "there are enough restaurants in Tucson to have dinner in a different one every day." The most important thing, says Ed, is that "we are all thankful to be well—all 16 of us." Thanks, Ed, for all the details.

Next, we hear of multi-activities of Roger

Wingate from the great state of New Hampshire. After retiring as director and executive VP of the Liberty Mutual Insurance Co., he took up country living in earnest, including but not limited to vegetable and flower gardening, two horses, chickens, geese, welding, blacksmithing, and building a horse barn. Even so, they take at least one trip a year—usually a Smithsonian Study Tour. Roger and his wife, Skipper, have four children and nine grandchildren, two of them graduated from college and one more this year. Roger keeps busy with several town activities: chairman of the N.H. Medical Malpractice Board, moderator of the town of Tuftonboro, director or trustee of the hospital, housing for the elderly, charitable land trusts, and on and on. He and wife Skipper are in "reasonably good health after 54 years of marriage."

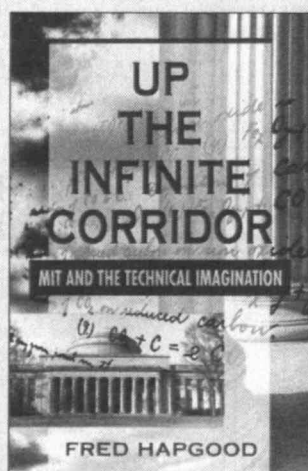
Regretfully, we report that Ruth Peters, wife of our President Phil Peters, has passed away after an extended illness at their long-time residence at Juniper Hill, Jackson, N.H. (They also have an apartment at Fox Hill Village, as previously reported.) She graduated in '73 from Wheaton College and attended both the Faelton Pianoforte School and the New England Conservatory of Music. Besides Phil, she leaves three sons and nine grandchildren. For many decades, she traveled extensively worldwide for pleasure and with Phil on business. I know all of us extend our deepest sympathies to Phil and his family.

Almost coincidentally, Pearl Klashman, wife of Lester Klashman, our former assistant secretary, then secretary, died at her Brookhaven residence in Lexington. Pearl was born in Malden, Mass., graduated from Malden High,

Tufts University, Smith College and became a psychiatric social worker. She was a "Big Sister" to many underprivileged children. Her first marriage was to attorney George Lodgen, from whom she leaves two daughters. She married Lester Klashman after George's death, leaving her step-daughter, Martha Klashman. Further survivors were her brother, seven grandchildren, and one great-grandchild. (Ed: Among her many mourners are your present assistant secretary and his wife, Genevieve, who, between them, knew and loved her for at least some 60 years and who recall that she was instrumental in bringing about our second marriage.)

From press clippings from the *Pittsburgh Post-Gazette* sent by Mrs. Jane C. Karr, we learned of the death of Milton Karr, who graduated in naval architecture and marine engineering. He taught in those fields at MIT for three years, then was a naval architect for one year at the Navy's experimental Model Basin in Washington, then moved to Orange, Tex., to design and build a shipyard for the Navy. He joined the staff of U.S. Steel in 1940 and was promoted to the post of chief engineering executive of the company's West Coast operations in 1952. In 1964, he joined the staff at U.S. Steel headquarters in Pittsburgh, retiring in 1979 as general manager, following which he was called back as a consultant for three years. Then he joined the International Executive Service Corp. until the day he passed away. He is survived by his wife, a son, a daughter, and three sisters. All the bereaved have our deep sympathies.—Leonard A. Seder, assistant secretary, 1010 Waltham St., B342,

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# 38

Under a Kansas City, Mo., dateline we see "Local Engineer Finds Asian Industrial Hot Spots Booming." The article continues, "Explosion was the term used by Kansas

City's leading industrial engineer **Richard Muther** upon returning in November from his eighth trip to the fastest growing industrial hot spots of the world, Shanghai, China, and Bangkok, Thailand." The article relates the details of Dick's month-long visit conducting working seminars and consulting with developers on industrial facilities planning.

The trip was built around his presentation of the keynote address at the International Conference on Advanced Techniques and Equipment for Materials Handling sponsored by the Chinese Mechanical Engineering Society. This Shanghai keynote address, "Nothing Happens Without Movement," pointed out new opportunities for the Pudong Project, a long-term plan for relocating industrial plants and warehouses away from congested Shanghai City and its river-restricted harbor.

Dick Muther's concern is that the planners are not thinking big enough; that visionary planning is getting lost in the shuffle; and that unless greater attention is paid to what could be a limited infrastructure, the Pudong area could become congested in less than 50 years.

**Matthijs Boissevain** writes from Noank, Conn., that he's writing an autobiography, a book on the physics of sound and harmony, and making a genealogical study of all descendants of his Huguenot ancestor **Lucas Boissevain** who fled France in 1686 to find religious freedom in Holland. Matt has 1732 descendants, 1320 of whom are living today spread all over the world.

**Russell Coile** in January completed five years as disaster coordinator for the City of Pacific Grove, Calif. He was in the first group in the country to be designated a "certified emergency manager." There are now 29 in California and about 250 in all 50 states. FEMA gives the city a grant for half of his salary. He writes that his mid-life career change from operations research to emergency management has been interesting. He was sent to Northridge, Calif., to help out after the January 1994 earthquake.

**Professor Clark Robinson**, who received a bachelor's degree with us and continued on to get a PhD in physics in 1943, advises that he is in good health now and is spending some time on experiments with UHF/VHF antennas. He lives 20 miles north of Bozeman, Mont., more or less in the woods and writes that visitors are welcome, from any class.

Last summer **Eleanor and Frank Gardner** together with 17 family members traveled to Turkey to visit the place where Eleanor grew up. They toured what many of our class know as Robert College which is now University of the Bosphorus. In addition to Istanbul, they spent their 14 days in Kilyos, the Princess Islands, Troy, and Ephesus. In December they moved to a consulting care retirement community called Wake Robin and are living at 602 Wake Robin Dr., Shelburne, VT 05482.

**Phyllis and Class Agent Don Severance** have

also moved to a retirement facility. They state that it is in the midst of woods and is still in the building stage. Although they have their own apartment complete with kitchen, they have at least one meal a day in the lovely dining room. Many of their Wellesley friends have taken this step before them. They find that after having been in their new location a mere three months, they seem to have conversations with more friends in a day than they had in a number of days in Wellesley. One unexpected benefit is that they have unraveled a web of acquaintances with almost everyone they have met in their new home at Franconia Village 219, 7 River Woods Dr., Exeter, NH 03833.

**John Garvin** who retired from Unisys Corp. and lives in Malvern, Pa., writes that he skied in Vermont early in the year 1994 but very soon thereafter had a brain stem stroke and as a result he can not swallow and since he lost his sense of balance, he cannot walk.

**C. Kingsland Coombs** died of a heart attack in August at Otterbein Retirement Community in Lebanon, Ohio. King graduated as a civil engineer but spent most of his career as a mechanical engineer. During WWII he served as a major in the Army. Later he was with the General Electric Co. in Erie, Pa., and transferred to Cincinnati to work with GE Aircraft Engines. He retired in 1980 and moved to Wyoming where he was active with the Boy Scouts of America and the Wyoming Presbyterian Church. Moving back to the Cincinnati area, he spent his retirement teaching children at the Cincinnati Nature Center near Milford. In 1993 he climbed a high peak in the Smokey Mountains, and over the years he traveled on nature center programs to Alaska, Iceland, England, and Scotland.

**Lillian M. "Polly" Thompson**, a prominent Oregon architect who supported the advancement of women in her profession, died of a stroke in June 1994 in a Portland hospital. During her youth, she worked at her father's stained glass studio, the Povey Brothers' Art Glass Co. She earned a degree in architecture from the University of Oregon and in 1929 married a fellow architectural student **Raymond Kermit Thompson**, who survives her.

She went on to earn a bachelor of architecture at MIT. Following WWII, she and her husband and two children returned to Portland and started the firm **Thompson and Thompson, AIA, Architects**. She was active in the firm until her death. Mrs. Thompson designed the stained glass windows for a number of churches, and her husband co-designed. She also wrote articles and gave lectures on the subject of stained glass. In 1994 she was featured in an exhibit "Matriarchs - Pioneering Women of Architecture" sponsored by the Portland Chapter of the American Institute of Architects, and was also honored in May as a "Woman of Distinction" by the Columbia River Girl Scout Council.

If you already have not done so, arrange to attend our 1995 Mini-Reunion including dinner at the Wayside Inn, Sudbury, Mass., Saturday evening, June 17.—**Paul R. Des Jardins**, secretary, 6251 Old Dominion Dr., Apt. 310, McLean, VA 22101-4807, (703) 534-4813; **Gretchen Birge**, assistant secretary, 233 Carroll St., Apt. 202, Sunnyvale, CA 94086-6264, (408) 736-5011; **Frederick J. Kolb, Jr.**, president, 211 Oakridge Dr., Rochester, NY 14617-2511, (716) 342-3093

# ClassNotes

# 39

Pages MIT60-69 in the January 1995 *Technology Review* carry the comprehensive report on MIT's academic year of 1993-1994, written by President **Charles M. Vest**.

I recommend '39ers re-read his inspiring report, which tells us that, during the 1993-1994 school year: there were 4,509 undergraduates and 5,281 graduate students at MIT; the international population included 2,196 persons who originated in 101 countries; women students numbered 2,757; the first-year class included 502 self-reported minority students representing 46 percent of the class; degrees awarded included 1,092 bachelor's, 1,203 master's, 31 engineer's, and 516 doctorates; 2,660 students demonstrated need and received \$32,861,000 in grant aid and \$12,677,000 in student loans; 393 separate employing organizations conducted interviews in the central careers offices; gifts, grants, and bequests were \$94.6 million; the total financial operation amounted to \$1.14 billion. President Vest's 10-page report contains far more than these irrefutable statistics. We should be inspired, stimulated, and gratified to be among more than 96,000 living MIT alumni/ae.

**Lolita and John Renshaw** report progress on their fascinating proposal to create about \$30 billion dollars per year in new revenue for the U.S. Treasury. Writing in *Forbes* magazine, **Caspar W. Weinberger** describes John's capital gains proposal as "elegant in its simplicity and astounding in that it helps the taxpayer, the Treasury, and the economy while hurting no one." . . . **Hew Phillips** received the U.S. President's Award for Distinguished Federal Civilian Service at NASA for directing simulation and analytical studies on the Gemini, Apollo, and Shuttle programs. Also, he is a member of the Model Aviation Hall of Fame. He built many model airplanes and gliders to participate in contests and meets. At the Virginia Air and Space Museum, there is a model wind tunnel exhibit. Hew is building a strain gauge balance to demonstrate how drag is studied and air flows over airplane surfaces are optimized. Hew and Viola planned to visit Portland, Ore., and Seattle, Wash., during the holiday season.

During **Barry Graham's** career with Aluminum Company of Canada, he made major contributions to its new hydroelectric generation and aluminum reduction plants at Kitimat, B.C. The plant produced aluminum ingot at a cost lower than that in any other plant in North and South America. Good news for us is that Barry and Wendy may include the Pacific Northwest in their 1995 travels. . . .

**Harold Muckley** and his family planned to fish near Key Largo, Fla., during year-end holidays. . . . **Richard Donohoe**, recipient of the MIT Award for Corporate Leadership, retired from successful contracting in Virginia and Maryland. Now he is an orchard farmer on Maryland's eastern shore. Once, as a serious backpacker, he covered 90 miles in the Rocky Mountains in one week. These days he leans more toward preparing soft-shelled crabs,



# Memories of MIT, 1936–1939

By L. M. Krishnan, SM '39

L.M. KRISHNAN came to MIT in 1936, after completing a master's degree in mathematics from the University of Madras. Three years later, a master's degree in electrical engineering in hand, he left by ship for India, by way of Europe, just as war was breaking out. He wrote a reminiscence of his experiences for his grandchildren and shared several chapters with *Technology Review*, from which the following material is excerpted. Not surprisingly, we chose aspects of his experience that offered the most dramatic contrast with the present. Hard work, of course, was the constant.—Ed.



This photo from a 1937 issue of *Technology Review* shows a projects lab that was probably familiar to L.M. Krishnan (left) as he pursued a master's degree in electrical engineering.

**W**hen I enrolled as a graduate student in electrical engineering, the normal workload for graduate students was 50 units, but I was counseled to cut back to 40 units for my first term, as I would need time to adjust to the fast pace at MIT. Even so, with classes in the forenoon on Saturdays, laboratory work, and study of European languages required of graduate students, it was easy to find myself working 60 or more hours per week to complete classwork.

Laboratory experiments were carried out in teams of two to four students, and preparation included an exercise in resuscitation, as there was a chance of being electrocuted while working on high-tension equipment. Expensive equipment was sometimes in short supply, and we had to work at a feverish pitch to complete the experiments during the three-hour lab period. The American students had an advantage in practical skills, having built their own radio sets. Fortunately, I was good at analyzing the

results and writing the reports, although such tasks often added up to more hours than were spent in the laboratory, and more hours than indicated by the units assigned. (Today's students make precisely the same complaint.—Ed.)

There was much flexibility in the choice of curriculum, and once, when I was unable to fit in my required courses because of a scheduling conflict, I was able to enroll in courses in photography and patent law. (*Not often reported by modern students!*)

There were some 3,000 students at MIT at the time, only 7 of whom were women. The students were free from the affectation and snobbery often found at elite British universities, and although everyone was very focused on their studies, there were social encounters that involved many levels of the Institute. Graduate students and staff held discussions over hot chocolate in the basement of Graduate House; the department head held a dinner for graduate students once a

year; and President Compton invited foreign graduate students to his home for high tea.

There was ragging (hazing) at the Institute, as in other colleges, but it was not overdone. One year I remember that a sophomore committee assigned the entire freshman class to bring in pet cats. The freshmen set out in pairs, with sacks over their shoulders and some delicacies to lure their quarry, and they returned in the wee hours with sacks full of struggling cats. Two of the students had been caught in the act by police, and at that point, "the cat was out of the bag," so to speak. When the police arrived at MIT to investigate further, they found the main lobby full of sacks with cats, and they had the job of trying to restore the animals to their rightful owners.

I joined the MIT Nautical Association soon after it was established in 1936 and learned to sail. That membership entitled me to join the Royal Madras Yacht Club. I later became the



first Indian commodore of the R.M.Y.C., and along the way I won the first all-India championship in the Waterwag class of boats in a regatta held at Khadakvasala. (When my wife, Gnanam, and I visited MIT on a world tour in 1971, we went to the Sailing Pavilion, and the sailing master produced my registration card in minutes. Gnanam, a past winner of the ladies' championship at the R.M.Y.C., took out a boat and impressed her student crew with her expert sailing.)

Over the course of the three years I was here, there were a total of 15 students from India at the Institute. It was advisable for Indian students to come a fortnight in advance, so as to equip themselves with warm clothing and, most important, to acquire and become proficient with a slide-rule. Bronchitis delayed my departure, however, and I joined class one day late. I had no time to purchase a slide rule, and for the first week I relied on Clark's Tables, a slow method of solving problems. Quizzes started almost immediately—five at the end of the first week—and my performance was poor. Despite the slow start, I was the first student from South India to graduate from MIT.

I remember many distinguished faculty and students who went on to notable careers. I took a physics class with Richard Feynman, and often had lunch with Norbert Wiener, who would make a bee-line to the table of Indian students at Walker Memorial. From a student's name, Professor Wiener could identify the region in India from which he hailed.

I was initially under the impression that the standard of education at American colleges was in general of a high order and that MIT was only marginally better. On hindsight, I realized that the standard of education at the Institute was not only pretty high, it was unique. □

which abound near his orchards.

Anne and Fred Schaller toured for three weeks in Oregon, Washington, and British Columbia. After a pleasant luncheon while viewing Puget Sound, the Tacoma Narrows Suspension Bridge, and snowcapped Olympic Mountains 60 miles to the northwest, the Schallers drove up Mt. St. Helens, which blew a cubic mile of its top 14 years ago. They carried a souvenir of volcano product pumice to their homestead in Wellesley. . . . Betsy and Bob Withington sent two photos from their three-week tour of China. One photo shows Betsy petting a panda larger than herself. The other shows Bob in a listening attitude before a 20-foot-high stern-faced stone statue of an ancient Chinese War Lord. Now the Withingtons divide time between skiing at Snowmass, Sun Valley, and Whistler and flying their Cessna to northwest airports where they constantly update their ratings of BLT sandwiches. . . . Fred Grant and George Beesley report Jean Dana's tender loving care hastened Joe Dana's recovery from his fall on a hard-surface Cape Cod tennis court. Manning Morrill reports that the Danas are skiing now with the Pulvers.

Eleanor and George Beesley drove to Exeter, N.H., and visited Phyl and Don Severance, '38, at their River Wood retirement condo. George and Eleanor liked what they saw, and may sell their home next summer and move to River Wood. . . . Sylvia and Seymour Sheinkopf have a newer, longer silver bullet trailer home. They expect to testrun it about May 1995 to California and the Northwest, and then return to Burtonsville. . . . Adie and Bill Pulver, skiing at Snowmass, Colo., expect to switch sportgear and scuba swim for a few months near Antigua. . . . Gus Hunnicke recovered from minor ailments, and he plans to absorb Caribbean sun for a few months.

Dave Frankel recovered completely from hip surgery, but does not claim he can jump over tall buildings in one leap. He did say that he and Sally were about to arrange lunch with two neighbor couples, who are Winona and Wiley Corl at Boca Raton, Fla., and Martha and Phil Epifano at Pompano Beach. . . . Ellen and Dave N. Lindberg left home in Carmichael, Calif., to attend a four-generation reunion of their family, about 40 miles south of Fairbanks, Alaska.

Good news is that seasonal hurricanes passed without damaging homes of Sybil and Bob Saunders on Johns Island, S.C., and Bea (Mrs. Irving) Peskoe in Homestead, Fla. . . . Dodie Casselman/Grissom and Don send greetings and news of solving last summer's travel crises. After a scenic cruise through the Panama Canal, Dodie fit in a four-way heart bypass and recovery before they visited London. Now they are home, sunning at Shell Point, Fla. . . . Aletta and Bob Touzalin visited us in Tacoma last summer. They left here intending to visit Jean and Bob Schmucker in Amherst, N.H. While eastbound, Bob T. started atrial fibrillation, and so they returned directly to Naples, Fla., where remedy was completed. Now the Touzalin twosome golfs four times weekly and audits scores on the 19th hole.

We are saddened by reports of death of two classmates: Edward Scott Pattison, Course XVA Sloan Fellows Program, died June 24, 1994, at Dunedin, Fla. There were no further details provided. . . . Antonio W. Diokno died

# ClassNotes

July 15, 1993, in Makati, The Philippines. He earned a master's degree and consulted in investment management. There were no other details.—Hal Seykota, secretary, 2853 Claremont Dr., Tacoma, WA 98407

## 40 55th Reunion

In October, D.J. and Charles Edwards participated in the MIT Alumni/ae-sponsored Swiss Alumni College study program. They stayed one week in the picturesque village of Meiringen. Part of each day was spent studying various aspects of Switzerland—the government, the economy, the banking system, the military, family life, cheesemaking, and winemaking. Another part of each day was spent on sightseeing trips in the area, including hikes through spectacular gorges, rides in gondolas up to an Alpine meadow, visiting the Swiss Open Air Museum of Ballenberg, and a train ride on a narrow-gauge steam cog railroad up to the 7,700-foot-high Rothorn. They are enthusiastic about their trip and would be glad to talk with anyone who is considering future study programs. Classmate Harry Cottle and wife Eleanor were one of the couples on the trip.

A note from Judson C. Rhode: "I guess I've really retired. I've given up tennis finally—my new wife, Vi, wants me to live as long as possible after heart surgery and a pacemaker—but I am still swimming and working out. Vi and I lost our respective spouses at this plush life-care residence, Vicars Landing, here in Sawgrass (Ponte Vedra, Fla.). We still spend considerable time at our condo in St. Croix, but not enough. I lost my oldest son to cancer last September, but enjoy following vicariously the careers of his technically trained sons and brothers."

Walter Helmreich writes, "I'm trying hard to increase participation (in class giving to the Alumni/ae Fund)." He adds, "I am sorry to report that Ted Gundlach died May 10, 1994, suffering a heart attack and other complications following surgery. Ted was at MIT only two years, going home to graduate from Buffalo University. He had a genuine engineering career, among other things, serving as chief engineer of a division of Colt Industries concerned with 'machining of metals.' I did not know him well at MIT, but we had good times with him and family while they lived in Michigan, and later in retirement, when they visited their son here."

John O. Crum of Visalia, Calif., passed away on March 10, 1994. His wife writes, "John was an aeronautical engineer with TRW for 38 years, attached to the Ballistic Missile Office at Norton Air Base, San Bernardino, Calif. He retired in July 1992. John was a devoted husband and father of two children and grandfather of one. He is very much missed by all who knew him."

We have also been notified of the death of William C. McDonald of San Diego, CA. There is no further information.



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George Wolfe called to say he had recovered from surgery and that both he and Phyllis are doing well. They were expecting to be in the Caribbean over the holidays and plan to attend the reunion.

Ricardo Menendez Castillo writes that he was surprised and saddened to learn of the death of Roberto de Arellano. He says, "I had several good friends at MIT, and Roberto was among them. I lost track of them when Fidel Castro ruled the island. My best friend and roommate, also a Cuban, was Sergio Martinez. Can you advise me of a contact in Cuba who could help me locate him? I plan to vacation in Cuba in January and would very much like to see him again." In checking with the Alumni/ae Office, I learned that they have record of only three MIT graduates in Cuba. Sergio Martinez is listed in the *Alumni/ae Register* with a Miami address. This information was sent to Ricardo.

David R. "Beano" Goodman sent me an amusing semi-autobiographical document entitled, "Confessions of an Old Wrestler." In it, he describes many humorous situations he encountered, or heard of, in his days as an amateur and professional wrestler. It provided me with some good laughs. It is much too long to reproduce here, but, if you write to Beano, perhaps he would supply a copy.

In a couple of months after you receive this copy of the *Review*, we will be getting together for the 55th reunion. I look forward to seeing many of you at that time. In the meantime, keep those letters and telephone calls coming to Richard E. Gladstone, secretary, 250 Hammond Pond Pkwy., 1205 S. Chestnut Hill, MA 02167-1528, (617) 969-5161

# 41

'Twas two days before Christmas, when all through the house  
No info was flowing, someone's a louse!

TR's deadline was here, with no news (or reindeer)  
To write up class notes for each '41 peer.  
"These guys must be sleeping, all snug in their beds,"

I began wondering, "Just what's in their heads?"

When what to my wondering eyes should appear, but

A postman in grey, I had nothing to fear!  
The card, hinting travels, composed by Blake (Wallace)

Provided some news and a partial solace.  
(Whew!)

It seems that in June, he traveled by stages  
On a route used by pilgrims in the Middle Ages.

Just where I'm not sure as the greetings were Spanish!

Future letters are promised to make vagueness vanish.

Then wonder of wonders, Sterling Ivison called.  
His thoughts for our 55th left me enthralled.  
He's mounting a campaign to convince our

Pres. Sepp  
That a Martha's Vineyard site would be particularly hep.

The Harborside there can accommodate all.  
With tennis, golf, and beaching, we'd all have a ball.

To add to the package he can provide for you all

Rides on his 40-foot sloop? ketch? or yawl?  
Zarskys with boat (Leona and Ed), sailing in from the Cape. His nautical chauffeurings then will they ape.

With no sense or duress friend Sterl volunteers  
To host a reception for his '41 peers  
At his digs on the Vineyard is his firm intent.  
Bad weather of course could require a tent!  
Please notify, Sepp, Sterling, or me when you can,

Of your interest in this, or some other great plan.

Less pleasant news then came from one friend  
Whose medical troubles at least should now end.

Chet Hasert past dentists who chiseled his jaws,

Has doctors who study hips arthritic flaws.  
His new hip they'll install on the 30th of Jan.  
By April his report could be, "I ran!"  
Now says the Santa Chas as he goes out of sight,  
"Merry Christmas to all, and to all a good night!"

Also Happy New Year and Happy Easter!  
—Charles. H. King, Jr., secretary, 7509 Seba-  
go Rd., Bethesda, MD, 20817-4839

# 42

We had a pleasant Thanksgiving dinner with Hazel and Fred Gander and Andree and Jack Alketruse. The Ganders winter in Dunedin and the Alketruses live year-round in

Largo. It was sort of a 1942 mini-reunion.  
Jean and I are spending our eighth winter here in Clearwater. There's good golfing, swimming and other activities. We both tutor at the local Middle School once a week. That's interesting and can be a challenge at times.

Bob Mayer's winter activity is snow skiing in the Berkshires and summer sailing his Star Class sailboat on Lake George. He says he keeps his brain alert by serving on the local planning board.

Bob Cunningham is teaching meteorology aboard the 125-foot Sea Education Association schooner *Westward*. They started at sea off Kent Island in Canada and sailed along the Maine coast to Boston and then to Wood's Hole. He says he may not have much sense left but he still has his sea legs.

One obit: John S. Stewart who practiced medicine in Norwalk, Ohio, passed away there in April, 1994. Our sympathy to Mary Lou and to the family.—Ken Rosett, secretary, Apt. #12, 2222 Americus Blvd. N., Clearwater, FL 34623

# 43

By the time these Notes appear, Susan and I will have moved from the ancestral home where I grew up and which has been in the family for over 60 years. It's an emo-

tional wrench, but we're going from two floors, plus basement and attic, to one level—what our daughter calls wheelchair-friendly. Neither of us is in one yet, but we'll be ready.

Walt Turner, '44, has kindly sent some news about Jim Leader, prominent honcho at our 50th. Jim, who lost his wife in 1993, lives in Richmond, Calif. He is actively engaged in operating an orchard in Washington state and commutes several times a year. . . . Clinton Springer, Class of '45 secretary and chairman



of its 50th Reunion Committee, is promoting a Navy V-12 reunion at the same time. All Class of '43 V-12ers are invited to attend the program, which culminates in a Victory Dinner Dance at Walker Memorial on Friday evening, June 16. Relive those thrilling days of yesteryear! . . . From Mt. Laurel, N.J., **Robert R. Marshall** (Course VII) sends a very brief note that he is enjoying retirement.

**William L. Sammons** (Course VI-A), Syracuse, N.Y., writes (via Frank Chinn, '44) to commend President Vest for his defense of MIT's student financial aid policies against the Justice Department's antitrust attack.

I must sadly report the passing, last September 14, of **Richard L. Ackerman, Jr.**, of Brookline, Mass. The only additional information is that he is survived by numerous cousins, to whom we extend our condolences.

If it weren't for members of other classes, this would be another set of newsless notes. Please, do something and then tell me about it.—**Bob Rorschach**, secretary, 4727 S. Lewis Pl., Tulsa, OK 74105

**44** We are sorry to report the deaths of **Edward H. Williams III** on March 17, 1994, and of **William O. Boschen** on July 18, 1994. We do not have other details. However, Bill was at our 50th in Maine and Cambridge.

Several classmates have sent notes on their activities. **John Barmby** relates that he is still active, teaching a public administration course at Marymount University. Also, he researches and writes to political representatives about current issues. His recent vacations were to California, the Carolinas, and New York City.

**John Cornell** writes that he is still running a dental testing and development lab. About our jubilee reunion, John says, "Lots of fun to see the classmates."

Just after Thanksgiving, we heard from **Dot** and **Walt Turner**. They have had exchange visits with **Dorothy** and **J.B. Gardner** and with **Emily** and **Will Rodemann**. Walt also mentions visits from **Steve Brown**, **Ken Wadleigh**, '43, and **Jim Leader**, '43. They all roomed together at Student House with Walt during his freshman year. This proves that "down east" is not so isolated after all.

Walt also sent a news clipping about **Will's** company, **Yachtsaver, Inc.** Yachtsaver is a system of portable or fixed air bags that can be placed inside a boat and instantly inflated from CO<sub>2</sub> cylinders to keep a craft afloat in an emergency. It was developed four years ago by **Will**. Originally produced for larger yachts, the system will soon be available for small craft with a displacement of up to 3,000 pounds. Several bags are currently installed on a twenty-foot sloop being sailed across the Pacific by a lone woman.

At our 50th reunion, **Lamar Field** asked me about his fraternity's building. I told him that the house is still a fraternity, but is coed. My answer was technically correct, but applied to the house next door. So, here's another try to answer him properly. **Lamar's** fraternity, **Delta Tau Delta**, at 255 St. Paul, had been relocated to 416 Beacon St. in Boston many years ago. The old house still stands and became the **Nu Epsilon Zeta** fraternity of Northeastern. Next door, 259 St. Paul, was the **Sigma Nu** fraternity. It is now **Epsilon Theta**, and is coed. This

seems an oxymoron in semantics to use the term "coed fraternity."

There have been other relocations. **Beta Theta Pi** moved from Brookline to 119 Bay State Rd. **Sigma Alpha Epsilon** moved from 58 Manchester Rd. to 484 Beacon St. A new brick house, **Zeta Beta Tau**, was built at 58 Manchester in 1962. It is also coed. **Theta Delta Chi** moved from 35 Bay State Rd. to 372 Memorial Dr. I do not find any recent listings for **Phi Kappa**, **Phi Mu Delta**, and **Sigma Alpha Mu**. The latter's location at 222 Babcock is now an apartment. The other fraternities from our era, continue at their locations. The mansion housing **Chi Phi** at Hereford and Commonwealth is now in the historic register of Boston.

Again, we are assisting **Clint Springer**, '45, secretary, in spreading the word about the Navy V-12 reunion next June. Because of WWII service, we have classmates whose graduation dates spread from 1943 through 1949. Since 1995 is the 50th anniversary of the end of WWII, the class of '45 welcomes all interested alumni. For dates, locations, etc., refer to the '45 Class Notes and **Clint Springer**.—Co-secretaries: **Louis R. Demarkles**, 77 Circuit Ave., Hyannis, MA 02601; **Frank K. Chin**, 221 St. Paul St., Brookline, MA 02146

## 45 50th Reunion

'Tis the week before Christmas but it shall be Easter time when you read these notes—some 60 days or thereabouts to 50th Reunion time with the clock counting.

You should have received all our Reunion mailings as well as Technology Day information by now. Our Reunion will not be complete without your attendance. Please plan to attend all or any part of this festive occasion. After all, you will never again celebrate '45's 50th!

Despite what you might fear, you still have plenty of time to finalize your plans. In fact, you will undoubtedly gain admission at the very last moment—but you may not be fully satisfied with your late hotel reservations.

In case you have forgotten (it often happens at our age): Friday, June 9: Graduation (Class of '95); June 10–11: an unstructured Boston weekend; June 12–15: Black Point Inn, Prouts Neck, Maine; Thursday, June 15: President Vest's reception, Pre-Pops dinner, Tech Night at the Pops; Friday, June 16: Technology Day, dinner-dance, Navy V-12 reunion; Saturday, June 17: fun and games.

Mrs. Gisele Lebel of Paris, France, advises that her husband, **Claude M.A. Lebel** died September 10, 1990. . . . **Cliff Corbett**, '46, wrote in early November to indicate his former business partner, **Robert S. Buston**, of Media, Pa., passed away on October 17, 1994. Bob is survived by his widow, **Dorothy**. . . . Mrs. Ann S. Halin indicates that husband, **Bradley Halin**, died on April 30, 1992. . . . Lastly, **Warren H. Miller** of Buffalo, N.Y.—a most conscientious alumnus and Technology Day attendee—passed away after a short bout with cancer on October 17, 1994.

**Dunc Luce** continues to be academically active as director of the Institute for Mathematical Behavioral Sciences, Distinguished Research Professor of Cognitive Sciences and

# ClassNotes

Research, and professor of Economics at UC/Irvine. . . . **Curt Beck** of Pampa, Tex. continues to be a consulting engineer in environmental sciences.

See you all in June at our 50th Reunion.—**Clinton H. Springer**, secretary, P.O. Box 288, New Castle, NH 03854

## 46

**Don Burke** writes, "Classmate and Course XVI mate **Don Robison** and I covered College Night at our junior college a few weeks ago. The local high school kids interested in college seem pretty well prepared, if they are enrolled in advanced technologies courses in certain of our schools that offer such programs. If not, then some other place is best for them. Don carries on as an Education Counselor for several of these higher-level schools. Why some of the more recent MIT graduates do not step up to this rewarding job is a real mystery to me."

**Bob Hoffman** lets us know about 50th Reunion plans. The committee—**Jim Craig**, **Glen Dorflinger**, **Joun Gunnarson**, **Herb Oedel**, and **Ned Tebbetts**—has decided that the reunion will be held at the Double Tree Hotel in Newport, R.I. and will be on June 9, 10, and 11, 1996. . . . **Clinton Springer**, '45, is developing the Navy V-12 reunion, which will be held at Walker Memorial. **Bill Lucero** hopes to be there.

**Ken Davis** tells us that his daughter just got married, after her 1994 graduation from MIT Sloan School. Now she lives and works near Denver. . . . **Polly** and **Bob Zucker** "went on a cruise down the Amazon and along South America in the Spring, and just came off another one in the southern Caribbean—so much for excitement this year." He had a minor problem in discovering that he has a weak heart muscle, a condition that probably existed for a while, but he's on track as you can see. . . . **Pauline Teague** sends a card showing a picture of Bangkok, Thailand. "Having a fine trip with an Elderhostel Group!" . . . A short note from **Mario Vinci** tells us the sad news that his wife died suddenly in October.

A letter comes from **John Taylor**, whom I haven't seen in a long time. He went on a two-week Elderhostel trip to New Orleans and Pensacola and "dined at Cajun, Creole, and soul food restaurants, attended a Pete Fountain concert, and toured the area. Much fun!" After that, he and **Nancy** toured through Colorado. The last day of July, they went on a 12-mile hike, and they "noticed a wisp of smoke on the ridge." They found that their lodge was burning—with all their belongings inside. John and other drivers made their way through the dense smoke to retrieve their cars. Other hikers piled in, and they fled down the mountain, so there were no injuries in this major wildfire. . . . From the Alumni/ae Office, we hear that **Robert Bolger** passed away December 7, 1993. He had lived for some time in Los Angeles. He will be missed.—**Jim Ray**, secretary, 2520 S. Ivanhoe Pl., Denver, CO 80222



Thanks to Ted Davis for sending us a newspaper clipping about Howard Zwemer.

Howard recently established an endowment fund at MIT that will make scholarships

available to students from the Bay Hundred-St. Michaels districts of Talbot County, Md. (Howard lives in St. Michaels.) He wants to encourage students to attend MIT because he believes a technology-based degree is an asset to any career. During Howard's career, he worked on supersonic wind tunnels at MIT and then worked in Palo Alto, Calif., on missile design. After that, he did operations analysis for the Air Force in Washington and later—still in Washington—worked for a defense consulting firm until he retired.

Back to Ted Davis. Ted and his wife Nancy live in Golden, Colo.—only 20 miles or so from us. He retired from Martin-Marietta six years ago. His last assignment there was as engineering manager on the Titan 4 missile. Now he enjoys playing golf, traveling, and for the last two years, has been taking a course in upholstery. He says that it is absolutely fascinating. Ted and Nancy have three children and eight grandchildren. Their oldest daughter, Cathy Abbott, lives in Lexington, Mass., with three children. Their son, Jim, is a Seattle-area attorney with three children. Their youngest, Barbara Wehrman, lives in San Diego with three children.

A note from Abbot Fletcher: his recent sailing trips have included Maine to the Bahamas, four weeks in the Society Islands (Tahiti, Moorea, Huahine, Raiatea, Bora Bora), Maine to the Azores to Portugal, and the east coast of

Hudson Bay! Now he'll be a landlubber until the Marion, Mass., to Bermuda race next June.

Stanley Landgraf retired from Kirkwood, Mo., to Cape Cod in 1986. He's secretary-treasurer of the MIT Club of Cape Cod and president of the Harwich Historical Society.

We received a newspaper obituary notice about John Holmes that deserves to be quoted in its entirety: *John Holmes of the 'Holmestead.' That's the name at his front door in Sun City. Once he met a person, John kind of moved into that person's heart and homesteaded there. His widow, Ruhama, is still receiving letters and calls from his Spanish students, many of whom he started teaching in Club Espanol in 1982.*

*John was more than a teacher. He was a friend and a confidante. He made everyone he met feel 'up close and personal.'*

*John was a great maestro of Spanish. He spoke Spanish, he lived Spanish, he thought Spanish. Above all, he loved to teach Spanish. In addition to teaching Club Espanol classes, he taught a private group at Westbrook Village. In 1987 he was named Sun City West 'Man of the Year' for his work as a volunteer teaching English to Spanish speaking persons at Dysart Community Center.*

*He devoted a full measure of his life to teaching a language he loved and on July 24, John died, peacefully and quietly in his sleep. "Lo echaremos de menos, Juan."*

We also received a notice this month that Ralph Strawn died in April 1994 in Malvern, Pa. He is survived by his wife.

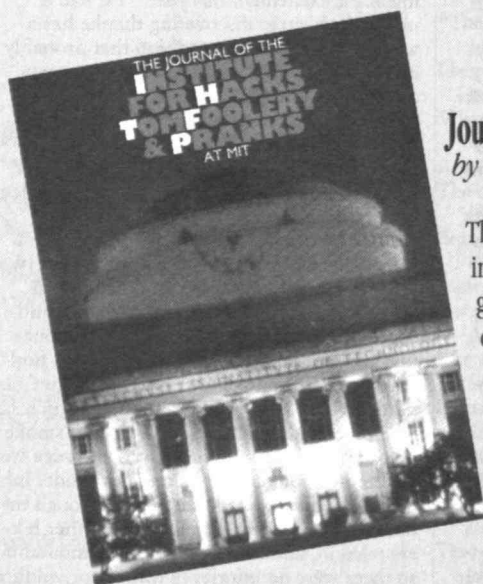
Ann and I spent three and a half weeks in New Zealand and Sydney, Australia, in Octo-

ber and November. That was our third trip to New Zealand in 10 years. We love that country. The people love to entertain overseas visitors, the scenery is indescribably beautiful, and the country is very uncrowded. There are only 3 million plus people (60 million sheep, though). And N.Z. is the only country in the world where the Federal Reserve Bank is required by law to keep inflation between zero and 2 percent! The economy has been completely reformed in the last ten years. It is now about as close to a pure free market economy as one can find—and it's working! We were afraid we were going to have one small problem. We were afraid we wouldn't be able to get more than cursory results of the U.S. election (which took place while we were gone) because it's almost impossible to find international newspapers in N.Z. However, we found out that ITN does an international newscast each morning so we were able to hear (and celebrate!) the election results the day after it happened. And, as it turned out, the election was such a political earthquake that the local papers carried detailed accounts.—R.E. (Bob) McBride, secretary, 1511 E. Northcrest Dr., Highlands Ranch, CO 80126

Betsy and Bill Maley recently enjoyed a pleasant visit with Ann and Ken Brock. After leaving Ann and Ken's house, Betsy and Bill stopped in Wellfleet, Mass., for a tour of

the town, where Bill spotted a tall gentleman and said to Betsy, "That couldn't be Dave Cist." She responded, "Yes, it is Dave Cist."

**Hack** \ˈhak\ *n* 1: A prank, usually elaborate. *v* 1: To perform a prank. 2: To explore the places on campus that are not usually accessible. 3: To work at or study a subject not especially for academic gain.



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They walked over to check, and indeed it was Dave Cist. Mary and Dave own a house on the ocean that Dave and his brother built with their own labor before WWII. There is an ocean view from every window. One picture on the wall is a magnificent photograph in which Dave captured his son jumping off the dunes, which are about 30 feet high. Dave, modest as ever, calls their house "a shack built on the dunes." Due to erosion of the sand dunes, the house has had to be moved twice.

Gloria and Sonny Monosson used to joke that their four daughters outnumbered Sonny on many matters; now their first two grandchildren are Alex and Sam, who nearly balance the ratio of females to males in their family. Gloria and Sonny recently joined Judy and Graham Sterling on a cruise from Boston to Bermuda, to evaluate whether such a cruise should be an optional part of our 50th Reunion activities. Graham writes that they explored cocktail lounges, theaters, game rooms, fitness centers and restaurants available on ten decks of the ship. They selected a moderate-price cabin on Deck 8, which met all their needs. The food service was excellent and compared favorably to past reunion meals at Chatham Bars Inn, Nantucket Inn and Walker Memorial. Formal and informal entertainment—including ballroom dancing, group singing, calypso bands, stage and fashion shows, and movies—was available at no additional charge and was more than adequate to fill the waking hours and to subdue the instinct to spend additional money. In Bermuda, they declined the packaged tours and explored on their own. Graham prepared a detailed expense analysis, including transportation from home to dock: costs were approximately \$3,400 per couple in a deluxe outside cabin and \$2,800 per couple in a smaller inside cabin. The pleasant experiences prompt Graham to write, "Anyone who has not been to Bermuda should do so."

Clint Springer, '45, as secretary of his Class, has worked hard to organize a reunion of all V-12 students. On Friday evening, June 16, 1995, a Victory Dinner Dance will be held in Walker Memorial, featuring music of the 1940s. A mailing list has been compiled of 700 alumni who served in the U.S.S. Graduate House between July 1943 and February 1946. If you have not received an invitation and would like to attend, contact the Alumni/ae Association; if you were not in V-12 and want to attend—join the celebration.

Our Class of 1948 Champagne Brunch at the MIT Endicott House was held in December. In addition to 30 prior attendees, Dave Powers and his wife were there, and several members of '47 and '49 joined us. The event is a social occasion, but we informally exchanged ideas about class activities. Denny McNear reported on Life Income Plans, which provide income for the life of the donor and a designated beneficiary. Sonny Monosson, Graham Sterling, and George Clifford discussed plans for the 50th Reunion, including proposed on-campus activities such as cocktail hours and meals at which the cost to attend will be held to a minimal amount. Some interest was expressed in holding a 48th Reunion in 1996 at an off-campus location.

Norm Herbert likes being professor emeritus. He teaches in the fall, but last spring he went to Borovichi, Russia, and taught microeconomics in a new college. Then he went to

the Carpathian Mountains with a Romanian friend and her son. Norm would like to hear from his Kappa Sigma brothers about plans for their next reunion. . . . Don Kornreich writes from Incline Village. He is busy planning and raising funds to solve transportation and erosion problems in the Lake Tahoe region. He also finds time for golf, tennis, skiing, hiking, trail-building, and the local Lions Club. . . . Since retiring from the National Climatic Data Center, Lewis Blodgett does volunteer work at Asheville Botanical Gardens and trail maintenance with the Carolina Mountain Club. His wife joins in these activities. He has been a member of the American Meteorological Society since 1945 and continues this interest, keeping a rain gauge and max-min thermometer. His grandchildren live nearby.

Agnes and George Fontas made another trip to Greece, and despite several rainy days, they visited many villages. They bought a wool blanket in a village known for the warmth and quality of its materials. They speak Greek and were surprised one Sunday to encounter many citizens traveling from urban homes to distant outlying villages in order to vote. Greek laws require citizens to vote in the town of their birth. . . . Herb Kinder continues his firm, Center For Management Effectiveness, in Pacific Palisades. They publish training materials. He has five books in print. The latest is *Strategic and Interpersonal Skill Building*, published by Harcourt Brace. His wife, Marilyn, is a frequent co-author, and she is an executive consultant. They have five grandchildren.

Joseph Luceri died at his home in Andover, Mass., from lung cancer. His daughter, Loretta Luceri Gallagher, writes, "Dad was proud of his MIT heritage. He loved to tell of how he matriculated during the three-year accelerated program. He commuted from Lawrence to MIT via trolley and subway for over three hours round-trip, six days every week. He was the quintessential MIT engineer: we still find neat notes written in 'engineer script' all over the house. Directions on everything from how to operate the VCR to lists upon lists of important information are all over the house. Dad was awarded several patents by the U.S. Patent Office. We always had the best-designed Halloween costumes, the best Boy Scout 'Pinewood Derby' model car, and the most original science projects in school. In his later years as a grandparent, Dad loved nothing better than to entertain the grandchildren as a master magician—he was really good!" When Joe graduated from MIT, he was not only his parents' pride and joy but he was also the hope and strength for many immigrant Italian families who knew the Luceri family. Before retiring, he worked at AVCO in Wilmington. On behalf of our classmates I extend our sympathy to Joe's wife, Evangeline, and her family. . . . We have word that Richard E. Mould died. He had been living in Encinitas, Calif.—Marty Billett, secretary, 16 Greenwood Ave., Barrington, RI 02806, (401) 245-8963

# 49

In reporting on Professor Dirk Jan Struik's 100th birthday in the January 1995 issue of this magazine, I wrote: "the mathematics department at MIT paid *fulsome* tribute to Profes-

# ClassNotes

sor Struik's career." Today (12/20/94), I received a kindly note from Dexter K. Bowers, '43, suggesting I look up "fulsome" in the dictionary. I did and, with apologies to Dr. Struik, can only say I thought fulsome meant the exact opposite of what the dictionary says. (Tech Review editors consulted their Webster's 10th which gives as a meaning "characterized by abundance," exactly what your secretary and editors did intend).

In Bermuda last June, Jim Christopher roamed the class banquet tables with his camcorder recording the words, statements, comments, thoughts, ideas, opinions, and views of all who came within range. Of particular note were the presentations made by Gene Wroblewski's wife, Lorry, and Joe Schneider, husband to Eunice. Clearly, they were having a great time. And so were all the rest. Perhaps being far from home brings out the thespian in people. The resulting tape was shown on Dec. 2, 1994, in Room 4-109 at the Institute to a core group of '49ers gathered to plan our next reunion. Those present were: Mickey Ligor (class president) and his wife, Pam; Harry Lambe (class treasurer) and his wife, Jean; Gene Wroblewski (class agent) and his wife, Lorry; Jim and Dot Christopher; Tom Toohy (past class president); Fletcher Eaton (class secretary) and his wife, Nell; and Eliza Dame from the Alumni/ae Office whose function is to insure that the full resources of the Institute are made available to the classes.

Among other items of business, we noted with much appreciation that Emilio Venegas has invited us down to Puerto Rico for a mini-reunion in 1996. We will keep you posted.

A news release from The Catholic University of America states that William C. Schneider, director of the first U.S. space station, Skylab, received an alumni achievement award in engineering on October 29, 1994, at the Omni Shoreham Hotel in Washington, D.C. Bill had received his doctorate in engineering from Catholic University in 1976. In 17 years with NASA he was acting director of the Gemini program, mission director of Gemini and Apollo 8, director of Skylab, and deputy associate administrator and associate administrator of NASA. A Fellow of the American Institute of Aeronautics and Astronautics, he is a consultant with Computer Sciences Corp. where he formerly served as VP for development of system sciences. He and his wife, Roseann, have four children, and six grandchildren.

An old and dear friend, Archie Harris, writes that, after 20 years as president and owner of Career Associates in Santa Ana, Calif., he has been forced to retire due to failing eyesight and now resides in Fountain Retirement Center, 1800 W. Culver Ave., Orange, CA 92668, (714) 938-0218. He was sorry to miss our 45th Reunion but was undergoing chemotherapy for bladder cancer. Fortunately, after two years of treatment, the cancer is now in remission. Archie would love to hear from us by phone or letter.

As of January 1, 1994, Thomas D. Higgins was elected a Fellow of IEEE. He is retired from Union Carbide Corp.



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For 35 years, **Jan B. Peyrot** was the man to see on engine controls at Pratt & Whitney aircraft. Now, he is retired but the corporation still needs his expertise and has been using him as a consultant for the past seven years.

I am saddened to report the passing of two of our classmates: **Raffaele Belluaro**, 74, and **Charles W. Jackson**, 75. Raffaele lived in Manchester, Conn., where he died on October 2, 1994. From his newspaper obituary, we learn that Mr. Belluaro graduated from MIT as an aeronautical engineer, joining Piasecki Helicopter in Pennsylvania. Later he joined the Research Laboratories of United Technologies where he worked for 27 years as a pioneer in the use of computers to solve scientific problems, becoming chief of the Simulation Laboratory. He taught for many years at Rensselaer Polytechnic Institute Graduate Center where he was an adjunct assistant professor. He is survived by his wife of almost 50 years, Shirley; a daughter, a son, and a granddaughter.

**Charles W. Jackson** died at his home in Janesville, Wisc., on August 26, 1994. During WWII, Charles served as a pilot with the United States Army Air Corps. Prior to his retirement in 1983, he was employed for 18 years as a sales engineer by Precision Seals, Inc. Surviving are his wife, Grace; a son, a daughter, and several nieces and nephews. On behalf of the class, I extend our most sincere condolences to the families of these two men.—**Fletcher Eaton**, secretary, 42 Perry Dr., Needham, MA 02192, (617) 449-1614

## 50 45th Reunion

As the large type proclaims, we are the 45th Reunion class. Plan to spend the week beginning June 12 in Newport with us.

In California for Thanksgiving I was able to reach a few classmates. **George Chippendale** retired from Lockheed in 1993 and has been doing some interesting volunteer work. One group he helps is Interplast, a group of surgeons and support people that travel to less-developed countries to do reconstructive surgery such as cleft palate repair on children. When he was a pilot, George flew the teams to Mexico. Another group he helps is the St. Vincent DePaul Society. The Society helps families with emergency needs in East Palo Alto. They deal with as many as eight calls a night. George, you are an inspiration to all of us seniors. . . . **John Cone** divides his loyalty between '49 and '50 since he graduated at midyear. MIT lists him with us, so I include him. He does urban economic consulting for SRI. He tried to retire in 1993, but his project got reactivated. An Elderhostel fan, George has been to China, Greece, and Norway. On a canoe trip down the Upper Salmon River in Idaho he navigated two or three rapids each day. . . . **Herb De Staebler** continues as an experimental physicist at the Stanford Linear Accelerator. He claims he is thinking about retirement. . . . **Jack Downhill** retired from the Air Force and is now active in real estate. He also enjoys taking part in operas in Los Angeles and Orange County. Jack plays a supernumerary, i.e., a non-singing part. . . . **John Gutai** retired from W.R. Grace in 1980. Since then he has joined Intex Recreation, a compa-

ny that deals in inflatable toys. John says he has no plans to retire. The toys are made in Fuzhou, China, where John travels from time to time. John enjoys his ten grandchildren which his three children have provided him. John is in touch with **Jim McGoldrick**, his fraternity brother. Jim is still with Alpha Associates, a computer company, and, according to John, does not plan on retiring either. . . . **Roy Hale** retired five years ago from the South Coast Air Quality Management District, a four-county agency. His travels have taken him to Alaska, Hawaii, and Moorea. The Alaska trip was a honeymoon trip. Roy remarried last August. Roy spent 10 years in the Air Force and then worked in the aerospace industry. He reports, "My proudest moment was in 1966 at Hughes Aircraft when we put our Surveyor (three-legged soft lander) on the moon, about three years before we sent Apollo crews." Nice going, Roy. . . . I missed **Ed Perkins**. He was off traveling in Europe.

I called **Bill Proctor** in Houston. He is still with Fluor Corp. but plans to retire in January (I write this in December) and plans to attend Reunion. See you then, Bill. Bill has an endodontist daughter in Chicago and a lawyer son in Philadelphia. Bill hears from his fraternity brother, **Dick Waltdt**, who has retired and moved to Green Valley, Ariz.

**John Litchfield** writes that he received the 1994 Carl R. Fellers Award of the Institute of Food Technologists. Congratulations, John. John labors as research leader at Battelle Memorial Institute. With his Christmas card, **Bill Enders** sent a clipping from *The Citizen* in Laconia, N.H. It reports his receiving the Vision of New Hampshire Award. The award recognizes Bill's "outstanding contribution to people in the Granite State who are blind and visually impaired," through his work on a device called Descriptive Video Service (DVS). It describes the visual elements of a program without interfering with the program's dialogue or sound effects. Bill, you also are an inspiration to us. Bill and Jean say they will attend Reunion.

Another clipping, this one from the *San Francisco Chronicle*, brought the sad news that **George Dawson** died last June. After MIT he went to Stanford for an MBA and then worked for SRI International rising to director of the minerals and metals group. In the 1980's George left SRI to found a real estate venture. He also was involved in research on electric automobiles and cold fusion.—**Robert A. Snedeker**, acting secretary, Seven Mashie Way, North Reading, MA 01864; **John T. McKenna**, secretary, P.O. Box 146, Cummaquid, MA 02637

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At the November 1994 meeting of the Acoustical Society of America (ASA), **William J. Cavanaugh** was presented with the society's Distinguished Service Citation "for diverse and sustained services in initiating and guiding society activities, in counseling colleagues in the society, and in introducing generations of students to acoustics." The word has for a long time been that if you want to meet the important people at the huge meetings of the ASA, simply find Bill because they will be the ones surrounding him. Bill started his acoustics career in 1954 with Bolt Beranek and



Newman. In 1970 he became VP in charge of their Architectural Technologies Division. Shortly thereafter he founded Cavanaugh Copley Associates.

In 1975 he formed his current organization, Cavanaugh Tocci Associates, Inc. Bill is known as the driving force behind much of what has been accomplished within the ASA. In his work on their Technical Committee on Architectural Acoustics, he helped initiate their Knudsen Lecture series and their distinguished lecture program. He has been very instrumental in strengthening the previously distant relationships among the many acoustical societies and associations. In 1954, he developed a suggestion that the centennial of Wallace Sabine's work be honored with a world class event bringing together people from all over the globe. While president of the National Council of Acoustical Consultants, he overcame a reluctance among members to publish their works rather than keeping them as trade secrets. The result was a doubling in that organization's membership. With all of this work, Bill has helped our class through his efforts on several of our reunion committees.

In April 1994, Ernest Warburton became the recipient of the American Physics Society's Bonner Prize for "pioneering contributions to our understanding of the structure of light nuclei via the development and exploitation of experimental techniques in nuclear spectroscopy combined with theoretical analysis." Though struggling with cancer at the time, he attended and addressed the conference. He said later that this award from his colleagues was such a source of pleasure to him that if he was allowed to have this Bonner prize and cancer or neither, he would have to think. Unfortunately the down side of that combination also held, and he passed away the following month. Ernie spent most of his career at the Brookhaven National Laboratory (BNL). He came there after spending three years teaching at Princeton University.

In 1961, he started a decade of work with the BNL 3MeV Van de Graaf generator. These years were punctuated with two fellowship periods at Oxford University. In 1970, he started work with their new Tandem Van de Graaf. From 1979 to 1984 he headed the Tandem research group. At BNL he became an inspiration for many budding physicists. He was known for his adeptness at both experimental and theoretical work. His theoretical works included studies of the first forbidden beta decay, an unlikely transition in which the nucleus emits or absorbs an electron or positron and the outcome is used in the study of nuclear structure. The world of physics and our class has lost a notable member. We extend our sincerest condolences to his family.

The Institute of Packaging Professionals (IoPP) has named Aaron L. Brody as the 1994 member of the year. During the past year, he helped organize two new IoPP conferences. He conducted a technical update for a trade mission from Chad and edited a new book on modified atmosphere packaging. As member of the year, he was cited as one of the most knowledgeable and well respected packaging experts in this country.

Only semiretired, James H. Ballou is still doing small projects and consulting from a home office. After five daughters, he is enjoying the difference and rewards of four grandsons. . . . Having retired after 28 years at

Brookhaven National Laboratory, Leroy N. Blumberg is hoping to see more of his children and grandchildren and enjoying the sailing on Long Island Sound. . . . Retired and living in a solar house 10 miles north of Mt. Washington, Burton W. Dempster feels that while that site is not the end of the world, you can certainly see it from there.

After 36 years on the faculty of Syracuse University, Earl J. Kletzky has retired. He founded the undergraduate program in bio-engineering, served 17 years as the administrative director of the Institute for Sensory Research and 11 years as associate dean of the College of Engineering and Computer Science. He writes that in the past year he restored a classic "Blue Box" link trainer.

Sadly, Ed Richard wrote us that his wife of 44 years, Nancy, lost her courageous fight with cancer and passed away in March 1994. As late as February 1994, they were able to go skiing together. She passed away at home helped by their daughters and the Hospice of Metro Denver. We send our sincerest sympathies to Ed and his family.

We received the sad word of the passing of George E. Hogue in August 1994. He had retired in 1980 from his position as an electrical engineer at Westinghouse in Maryland. We extend our condolences to his wife, Eleanor, his daughter, and their four grandchildren.

We have sadly learned of the passing of Gilbert V. Cook in October 1994. He was retired from his position as an astronautics engineer with Martin Marietta in Colorado. We extend our condolences to his wife, Anne.—Martin N. Greenfield, secretary, 25 Darrell Dr., Randolph, MA 02368

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My wife points out that as retirement approaches, I should be planning for the sorts of activities I will want to undertake to keep myself busy, happy, and out of her

hair. She has lots to do, most of which won't do for me. For instance, while I am not absolutely disqualified for the League of Women Voters in these progressive times, they tend to take stands, while I would rather argue and take exception. I therefore have a real interest in the activities of those of you already retired: Is there inspiration for me in your experience? Well, yes and no. Bob Damon, for instance, likes to compete in triathlons, inspiring to be sure, but not for me. Similarly, I am moved more to admiration than emulation by Art Turner, who in retirement devotes himself to making wood chips, leaving behind a useful and decorative residue of wooden bowls, trays, and what not.

Art and Sally continue to love to sail and travel. Recently they visited Ireland with Art's mother, who promoted the trip at age 90; I find that inspirational. Art's older son has obtained a master's degree from RPI, and is now working a 12-hour night shift job in a semiconductor manufacturing plant in Austin. Hours like that would inspire me to retire immediately.

Nick Haritatos also sees the imminence of retirement, but meanwhile he is working hard on new projects for Chevron, entailing a lot of travel to Europe and the Gulf coast. His son has been studying music in Bremen, not with the town musicians, but at the Akademie fuer

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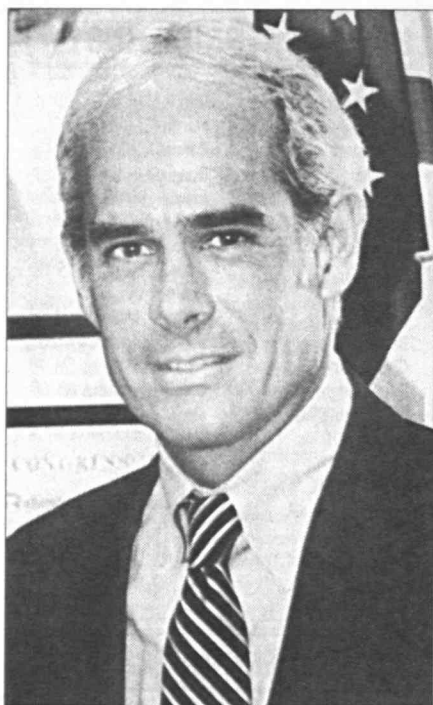
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**A**s the new chairman of the House Appropriations Subcommittee on Labor, Health and Human Services, and Education, Rep. John Porter (D-Ill.), '57, will be considering a wide range of programs including biomedical research, student loans and grants, assistance for the disabled, primary and secondary education, Head Start, and the Corporation for Public Broadcasting. The subcommittee, which oversees an annual funding bill of approximately \$275 billion, is also responsible for major entitlement and mandated programs such as Medicaid, Medicare, and Social Security.

According to a press release from his office, one of Porter's priorities will be Impact Aid, federal reimbursement to schools that serve children from nearby military installations. He also strongly supports biomedical research at the National Institutes of Health (NIH). Porter praises NIH as "a vital institution in the fight to prevent and cure deadly disease and the underpinning of our nation's biotechnology industry, an area in which America is the undisputed world leader and which creates skilled, high-paying jobs that support our economy."

Alte Musik. His daughter is closing in on a PhD in biology at Cornell. Nancy works part-time as a library systems specialist at the Patriarch Athenagoras Orthodox Institute in Berkeley, and is also acting superintendent of the Sunday-school program at the Greek Orthodox Cathedral in Oakland.

I look forward to hearing news from all of you, inspiring or not.—Richard F. Lacey, secretary, 2340 Cowper St., Palo Alto, CA 94301; e-mail: <rlacey@hpl.hp.com>

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Edward Leonard wrote that he is still a professor of chemical engineering at Columbia University. He is "...working on technologies to rid the transfusable blood supply of viruses and new methods for preventing cardiovascular implants from causing thrombosis." Also, he was elected a fellow of the American Institute of Medical and Biological Engineers. . . . Recently, Arndt von Hippel published his fourth book, *Human Evolutionary Biology: Human Anatomy and Physiology from an Evolutionary Perspective*. My records show that he is a thoracic surgeon in Anchorage, Alaska.

Fred Brecher included some information in a recent letter to me. For one, he reported that he "...talks to Audrey and Joe Cahn on a regular basis and they are fine. Joe has developed a strong interest in the effects of an earthquake (not surprising since they live a few blocks from the Santa Monica thruway). I've been sending him copies of reports I've been getting from the professional publications about the post Northridge investigation." Fred also noted that he and Jeanette will be leading a group of the members of the Carpenters Co. of the City and County of Philadelphia on a trip to Great Britain next Spring to visit the Worshipful Company of Carpenters in London." Lastly, Fred asked me to inquire if anyone is interested in being named as class agent. (If yes, write Fred at 2300 Walnut St., Suite 505, Philadelphia, PA 19103.)

In closing, let me report that I have seen or talked to Jay Berlove, Gil Gardner, and Bill Gouse within the last month. Carol and Jay are making plans to move to Ontario sometime next year; by then, it looks as though both of their children, as well, will be living north of the lower 48 states. That is, their younger son is now on the staff at the University of Toronto and they expect their older son to be reassigned to Anchorage shortly. . . . The Gardners, Gouses, and the Wohls foregathered at various times and places, happily and pleasantly, but only for personal and social purposes.—Martin Wohl, secretary, 4800 Randolph Dr., Annandale, VA 22003, (703) 354-1747

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The usual Christmas letter accompanied the seasonal card from Elaine and Roger Griffin. Children, grandchildren, and golf still dominate their lives, apparently. They did manage to get in a trip to Switzerland and Austria last year, however. Roger hasn't retired yet, which means that he will soon be in the minority among classmates.

On the other hand, Ed Brandt has sent word that he has retired from IBM after all these years, and is enjoying life along the Con-

necticut shore. And that is also the status (almost) of your faithful secretary. As of January 1, I have retired as president of the University of Bridgeport and taken on several new titles at that fine institution. I am now president emeritus and university professor. The latter title is the operative one—it means that I can teach a math course or two, work on special projects of my choice, goof off, or any combination of the above. Right now, I am mediating about life and, like Ed Brandt, enjoying the Connecticut shore. And that's the news we have at this time. Let me hear from you.—Edwin G. Eigel, Jr., secretary, 33 Peperbush Lane, Fairfield, CT 06430

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## 40th Reunion

Dell (Lanier) Venarde, Course X, writes a welcome note that she, too, hopes to make it to our reunion, which, by the time you read this (unlike when we write it, in the pre-Christmas season, when such things seem very distant), should be coming up very soon now. How exciting! We hope that many of you make it to the Black Point Inn on Prout's Neck, Maine, to renew old acquaintances, maybe make some new ones, recollect some college memories, and (among other things) give us class secretaries something to write about for those who couldn't make it for several months to come! Dell goes on to say that she is leading outdoor programs for children at several Delaware parks. Husband Jack is retired but still consulting between vacations—southern France, the Adirondacks, Florida, Cambridge, and Martha's Vineyard during 1994. Bruce, their older son, has a PhD from Harvard and is looking for a tenure track job in medical history (if anyone has any leads). They live in Wilmington, Del.

Richard McCammon, Course XII-A, received a Meritorious Service Award, the second highest honor given by the U.S. Department of the Interior, for his fundamental scientific contributions and leadership in the field of quantitative mineral resources assessment. He developed the quantitative assessment methodology for the National Uranium Resources Evaluation Program, a national effort to evaluate domestic undiscovered uranium resources. After receiving an SB in geology, Richard went on to get a master's from Michigan State and a doctorate from Indiana University in 1959. He is a member of the International Association for Mathematical Geology and the Society of Economic Geologists. He lives with his wife, Helen, in Bethesda, Md., and they have two children, Catherine and Ian. We can hardly wait for that reunion to replenish our news supply, but meanwhile, the rest of you have to keep those cards and letters coming!—Co-secretaries: Roy M. Salzman, 10643 Montrose Ave., Apt. 2A, Bethesda, MD 20814; James H. Eacker, 3619 Folly Quarter Rd., Ellicott City, MD 21042

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R. Gordon Black of Mansfield, Ohio, reports that since he left the Ohio Brass Co. in 1986 he has been managing the family real estate and investments. Since 1988 he



has been racing vintage Lotus sports cars. His first grandson was born in March to his son Martin, '79, and his wife.

George Forsen of Potomac, Md., is currently providing custom computer applications for the FBI Laboratory in Washington, D.C. A recent example of his applications was the prototype of the case management system for the FBI's DNA forensic examination program. George supports the Undergraduate Research Opportunities Program concept, and comments that his own work/study experience showed the importance of a post-graduate degree. It makes the difference between just work and "interesting" work.

Jay M. Silverston of Boston has become the VP of General Ship Corp.

Send news to **Ralph A. Kohl**, cosecretary, 54 Bound Brook Rd., Newton, MA 02161; e-mail: <kohl@ll.mit.edu>

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Please send news for this column to:  
**John Christian**, secretary  
7 Union Wharf  
Boston, MA 02109

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Lots of news in the mail bag this month! In alphabetical order: **Jorge Alfert** writes, "I am now VP of technical services for W. R. Grace and Co., Latin America. Our

headquarters moved from New York to Boca Raton in 1991, which puts me closer to many friends and relatives from Cuba. My son Edward graduated from Georgia Tech and works in Atlanta, while my other son, George, is in college and works with me at Grace. My youngest, Myra, is applying to college this year. I continue to travel worldwide, and my wife, Mayra, joins me on some occasions, including a visit to Boston and MIT this September." . . . **David J. Bentley, Jr.**, writes, "I'm continuing to relish my retirement years in New Mexico. It is truly the Land of Enchantment. My time is spent working part-time as a free-lance editor, consulting, and pursuing interests such as gardening. Together, Sue and I delight in playing bridge, partaking in the many cultural activities available in Albuquerque, enjoying outdoor activities such as hiking, and traveling to visit our five children and five grandchildren. I manage to keep my ties to MIT as an educational counselor and as secretary of the revitalized MIT Club of New Mexico."

**Toby Carlson** sends word that "Simple Gifts, the folk band to which I belong, has just issued its second CD, 'In a Place Just Right.' This makes our third recording during the four-year existence of the band." . . . At Brown University, **Paul Knopf** is now chairman of the Department of Molecular Microbiology and Immunology, a basic science department in the medical school. This is a joint appointment, which also involves teaching in the undergraduate college. Paul settled in at Brown in July 1972 after "wandering around the world." Since then he and his wife, Carol, a librarian in the Brown Demography Library, have maintained their interest in traveling, including sabbaticals in Melbourne, Australia, and London, England. Their son Jeffrey is an assistant professor in the University of South-

ern California Department of International Relations; their other son, Steven, is also in California, as a unit director at TRW; and their daughter, Rachael, is in fashion design as a color coordinator for Warnaco.

**Bernie Schneiderman** writes from Hawaii, "I married Sue Byrum, a commander, USN, and nurse-practitioner in pediatrics in the summer of 1993. This summer we trekked in New Zealand on a delayed honeymoon." . . . A news release from the American Society of Internal Medicine announces that **Herbert S. Waxman** received one of only two awards for



**Herbert Waxman**

outstanding service which were granted at the Society's 38th annual meeting. He was honored for his leadership as chair of the Federated Council for Internal Medicine, an organization comprised of leaders of the six major national organizations in internal medicine. After receiving his SB in applied biological sciences, Herb attended Harvard Medical School, graduating magna cum laude. He is now chair of the Department of Medicine at the Albert Einstein Medical Center and senior associate chair at Temple University School of Medicine in Philadelphia. An internist specializing in hematology, he has focused his research on sickle-cell disease as well as computer-assisted diagnosis.

Keep the news coming!—**Gary Fallick**, secretary, 4 Diehl Rd., Lexington, MA 02173

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**Gerald Schroeder** reports from Jerusalem that his oldest son, Avi, was elected to the national student council from among 1,400,000 candidates, and was then elected president of the organization. Gerald's wife, Barbara, writes for *Readers Digest* and *Woman's Day*, and their family picture appeared in the September 20, 1994, issue of the latter magazine. Gerald says, "My tour de force, 'Genesis and the Big Bang,' now tells readers in seven languages that relativity and Burgess shale fossils have finally matched science to the Bible!" . . . **James Robertson** retired in July 1994 and is professor emeritus of the University of California at Santa Barbara in their Departments of Mathematics and of Statistics and Applied Probability.

At Louisiana Tech University, **William T. Straughan** is involved in designing the Trenchless Technology Center Pipeline Rehabilitation Research Facility, doing research on buckling of plastic pipe liners, and teaching in the Civil Engineering Department. He was recently awarded the T.L. James College of Engineering Faculty Service Award. After graduating from MIT with an industrial management degree, he worked in the chemical, food processing, and manufactured housing industry for 27 years before returning to academia for a master's degree in civil engineering in 1986 from the University of Texas at Austin, after which he went even further to receive a PhD from Texas Tech at Lubbock in 1992, and

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then on to Louisiana. . . . A news release from the Department of the Interior honors **David Root**, who received the Meritorious Service Award recently. David works for the U.S. Geological Survey as a mathematician. The award is "for outstanding leadership in the development of methods to estimate the oil and gas resources to be derived from reserves in previously discovered fields, the largest component of the future domestic supply." David is regarded as an international expert and advisor on petroleum issues. After a mathematics degree from MIT, he received a doctorate from the University of Washington. He and his wife, Cherie, live in Virginia and have two children.

That's all for now. Thanks to those who have contributed, and as always, I urge you to *actually do it*: send an update, which will be most appreciated by your classmates.—**Dave Packer**, secretary, 31 The Great Rd., Bedford, MA 01730, (617) 275-4056; e-mail: <70421.1766@compuserve.com>

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## 35th Reunion

In a letter covering 34 years, **Niels Andersen** writes from Atlanta, Ga., that after leaving

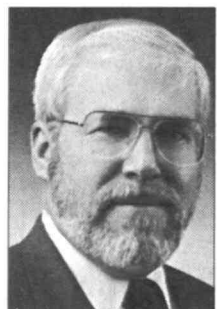
Tech he went to Stanford University for a year to get an MS in aeronautical engineering. From there it was the USAF and pilot training where he earned his wings and spent eight years flying C-135s and C-141s. In 1969 Niels joined Pan Am for what he hoped would be "a full and satisfying career . . . in an exciting technical group." Unfortunately, in 1991 with the demise of Pan Am, that phase of Niels's professional career was brought to an untimely conclusion. Along the way, "there was a marriage and a son and a daughter (now 25 and 22); while the children have survived, the marriage didn't, ending in 1981." After some aviation consulting work, in the summer of 1994 Niels joined PRC Aviation. Along the way, Niels also "developed a very happy relationship with a fellow long-time Pan Amer, Helga—a great gal, originally from Germany." Helga and Niels were married in August 1993, and had a commuting marriage until Niels moved to Atlanta, where Helga works for Delta Air Lines. Niels closes with a promise to be at our 35th Reunion. I hope more of you send your secretary letters like I got from Niels, and also that you plan to attend our 35th.

**Rob Stengle** writes that he recently was appointed associate dean of engineering at Princeton, where he continues as professor of mechanical and aerospace engineering. Rob's research currently is on intelligent control systems and control system robustness, including the use of parallel computers in control system design. Rob also reports that his book, *Optimal Control and Estimation*, has been republished. At this past summer's IEEE International Symposium on Intelligent Control, Rob gave a lecture on the intelligent control of automobiles. Rob's wife, Pegi, is the adminis-



trative assistant to the wife of Princeton's president. Their daughter, Brooke, recently completed an MS in education at the University of Pennsylvania and is on the staff of Bryn Mawr College. Son, Christopher, is a freshman at Lehigh and a recent Eagle Scout.

From Cherry Hill, N.J., comes word from Peter Silverberg that "nothing beats a career change." After 30 years of engineering, Peter became a chemistry teacher at Atlantic City (N.J.) High School and began an education of his own. Pete notes that "not all kids can grasp the concepts that we never even thought were hard." One redeeming feature is that the teaching facilities are great, having moved into a building that is "1994 modern—and has to be seen to be believed." . . . Larry Kravitz is still at Aberdeen, Md., evaluating a new assault gun for the Army. Daughter Clara



**Charles McCallum**

started her graduate program in physical therapy at University of Delaware, and Jennifer is a sophomore at Brandeis, hoping to eventually become a pediatrician. . . . From the Grand Rapids law firm of Warner, Norcross & Judd comes news that its managing partner, Charles McCallum, has been named chairman of the ABA's committee on law firms. The 125-member committee focuses on developments in law firm management, marketing, and quality

assurance practices. Charlie continues his practice in corporate and international law and his many civic endeavors, including serving as chair of the Michigan District Export Council.

In a letter from Tucson, Ariz., I get word that Mike Kasser has returned to the mainland after 10 years in Hawaii. Mike continues his purchase of investment properties for limited partnerships. Mike's quarterly report shows that he has 18 properties in Arizona, as well as some land holdings. The Holualoa companies, in Tucson—that's Mike's firm—would be happy to hear from anyone interested in getting into a Southwest real estate limited partnership. Mike plans to be at our 35th and I'm sure will be able to fill you in on the finer points of his business (and he may even bring a business plan or two with him!).

Thanks to all for the letters and notes. See you in June!—**Frank A. Tapparo**, secretary and class agent, 15 S. Montague St., Arlington, VA 22204

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Please send news for this column to: **Andrew Braun**, secretary, 464 Heath St., Chestnut Hill, MA 02167, or via Internet: <andrewb820@aol.com> or <abraun@husc4.harvard.edu>

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It is with sadness that I report the death of our classmate **Robert Allen Lytle**. His wife, Carol Crain Lytle, wrote to us in November, and I pass along the major portion of her note:

"It is with the greatest degree of sorrow that I (Carol) am informing you that my husband, Robert A. Lytle, Jr., was killed in a tragic auto accident on September 10, 1994. We were traveling together southbound on a two-lane road in perfect weather at 7:50 a.m. on a Saturday morning. A car was traveling northbound on the same two-lane road and the driver evidently fell asleep at the wheel and his car veered into our lane and hit us head-on. Both he and my husband were killed instantly. Our minivan rolled over and somehow I survived with a badly broken right arm.

"Bob had the most outgoing personality of anyone I've ever known. He was very proud to have gone to MIT and we visited the campus several times. Our three teenagers and I are totally devastated. He was a shining example of a great dad, husband, business person, and a community volunteer—a rare individual that MIT would be proud to have as a graduate." Bob was the managing principal at McLaren Hart Environmental in Southfield, Mich. Carol sent an obituary, and we received another notice from John D. Crissman, '61, who was a neighbor in Grosse Pointe Park, Mich. Robin (as he was known to many friends) was a Course II graduate and also received an MBA from the University of Rochester in 1968. He served in the U.S. Army Corps of Engineers and was a member of Delta Upsilon, the Grosse Pointe Yacht Club, Grosse Pointe Memorial Church, a former member of the Grosse Pointe Rotary Club and a past president of the Newcomers. In addition to his wife, he is survived by a daughter, Courtney L. Lytle; two sons, Thomas C. and Jay R. Lytle; and a sister, Mary Louise Stokes. Memorials

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may be made to the Grosse Pointe Memorial Church Memorial Fund, 16 Lakeshore, Grosse Pointe Farms, MI 48236. We send along the condolences of Robin's classmates at MIT to his wife and family.

**Ronald R. Troutman** sent us a note via the MIT Alumni/ae Office. He is still working at IBM's T. J. Watson Research Center on liquid crystal displays and was recently elected to the IBM Academy.

**Jeremy R. Goldberg** is working with the U.S. Navy's Sea Systems Command on DDG 993-class ships. His wife, Marcia, is Judaics and public affairs director for the Washington, D.C., Jewish Community Center. Son, Elliot, is a graduate student at George Washington University majoring in international affairs, and has a Fulbright grant in Jordan for the 1994-95 school year. Daughter, Devra (Yale '93), is working in economic analysis for KPMG Peat Marwick in Washington, D.C.

E-mail messages came in from **Ed Feustel** and **Phil Schmidt**. Ed and his son, Aaron, toured MIT and participated in the admissions discussions with a view to Aaron becoming a mechanical engineer in the Class of '99. Aaron was impressed by MIT but decided to apply for early decision at Clarkson University, where he was accepted.

**Phil Schmidt** has been named 1994 Texas Professor of the Year by the Carnegie Foundation for the Advancement of Teaching. The foundation designates one professor from each state in this annual program, from nominees submitted by various universities throughout the country. Phil is now in his 25th year as a professor of mechanical engineering at the University of Texas/Austin.

The Sunday, November 20, 1994, Business Section of the *New York Times* had a major article on Koch Industries and the ongoing adventures of the Koch family. There was a great picture of classmates **William** and **David** with brother Charles taken in the late 1950's at MIT, a picture of David in his office in New York, and pictures of Bill holding the America's Cup Trophy and with the all-women crew for the 1995 America's Cup competition.

If you have access to the Internet, please send your professional and personal news to: <MIT1962@mitvma.mit.edu>. Alternatively, you can send a message directly to me at: <uabhn01@asncube.asc.edu>. If you still communicate by traditional methods, please send your news and personal notes to: **Hank McCarl**, secretary, P.O. Box 352, Birmingham, AL 35201-0352

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Please send news for this column to: **Shoel M. Cohen**, secretary, Dept. of Psychology, Nassau Community College, Garden City, NY 11530; e-mail; Internet

<71271.2627@compuserve.com> or CompuServe <71271,2627>; home phone (516) 489-6465

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**Bill Young** (Course V) was a featured guest on *Wall Street Week with Louis Rukyer*. This particular show featured the #1 ranked analyst in chemicals, steel, and paper.

Bill has been ranked as the #1 chemical industry analyst for 16 years by the "Institutional Investor" All America Research Team. He is a VP and principal of Donaldson, Lufkin and Jenrette (DLJ).

Bill received a PhD from Berkeley and worked at IBM for five years. He said his co-workers were concerned because he was giving up the security of IBM. He has been on Wall Street for 22 years and at DLJ for 5.

Bill's son, David, will graduate in June from MIT in Course II, specializing in the biomedical area. His daughter, Wendy, graduated from NYU and is doing environmental work in Arizona.

**Laurence Rabineer** (Course VI) is director of the Information Principles Research Laboratory in AT&T's Bell Laboratories. He is working on moving speech and image processing technology out of the lab and into telecommunication products and services. His daughter Sheri is a second year law student at NYU while daughter Wendi is a senior in EE at Cornell, and daughter Toni is a freshman in high school.

After 15 years at Storage Technology, **Sam Taub** (Course VIII) has joined EMC Computer Systems as director of Marketing for EMC France. Sam and his wife, Gaby, now reside in Paris. His daughter, Sara, is a sophomore at Brown majoring in bio-ethics, and his son, Josh (Brown '93), is working in London with Conde Nast International.

**John Nagle** (Course XIV) of Syracuse University has published *Introduction to Comparative Politics: Challenges of Conflict and Change in a New Era* (Nelson-Hall, Chicago). Professor Nagle is director of the Russian-East European Studies Program and leads Syracuse University's traveling summer seminar in East-Central Europe. John sent this information notice in October and I received it in December for the April issue. For more timely news please communicate directly.—**Bill Ribich**, secretary, 18 Revere St., Lexington, MA 02173, (617) 862-3617, fax: (617) 890-4084

## 65 30th Reunion

**Peter Heinemann** offers the following thoughts as we move toward our 30th

Reunion: "It's hard to believe that it's time for another Reunion for the Class of 1965. Still, if you take '65 and add 30 to it, '95 is what you get, so '95 it is! This means it's time to return to the source of our collective wisdom. When we revisit our roots in Cambridge and Boston, it becomes a great chance to enjoy places from our past and to see what's new at the Institute.

"As part of this 30th Reunion (June 15-18, 1995), we are making plans for more memorable events you shouldn't miss. We plan on a Friday night gathering with a buffet where you can meet with other classmates who are attending. While the intention is to relax and let people get reacquainted, we'll also be organizing group participation in the MIT Alumni/ae Challenge Games, particularly the 'College Bowl.' Dinner Saturday night is still being detailed, but rest assured that we will have a memorable night of food and entertainment for all.

"On Sunday it is traditional to have a brunch, which allows everyone the chance to

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start the day with their classmates whether they are staying on in the Boston area or beginning the trip home.

"Your Reunion committee is made up of those who have served in the past, along with some who have responded through the 'Save the Date' mailings. This gives a broad base of support and should mean that their tasks will mostly involve encouraging you and all your friends among our classmates to attend. Please feel free to contact George (see below) or me at (508) 270-6914 if you would like to become more involved—there's still a lot to do!"

The idea that we've reached a 30th Reunion is somewhat disconcerting. On the other hand, we've just celebrated Xmas with our first grandchild so time does march on!—**George McKinney**, 33 Old Orchard Rd., Chestnut Hill, MA 02167; (617) 232-4710; e-mail: <gels@world.std.com>

EDITOR'S NOTE: **Jeffrey Meldman**, '65, PhD '75, is featured on page MIT 3. Check it out!

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The class listserv continues to supply the bulk of our news again this month. **Thomas B. Jones** (did you know there were three Tom Joneses in our class?) continues as professor

of electrical engineering at the University of Rochester. He was recently promoted to Fellow of the IEEE, cited for his work on the electromechanics of particles. Tom and his wife, Mary, get the bulk of their news of their older daughter, Laura, through e-mail too. Laura, an Asian studies major at Tufts, is at Nanzan University in Nagoya, Japan, for this year. . . . **Bill Cain** writes that "steady" is probably the best way to describe his life. He and his wife, Britt (UMass '67), have just cele-

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brated their 23rd wedding anniversary. They have a teenage son and daughter, both of whom make them proud. Bill began work at Execucum in Austin, Tex., in 1978 and stayed with the company when it was purchased by Comshare in 1991. He travels constantly doing software support and spends his home time on church, golf, and swimming. . . . **Sammy Shina** is an associate professor in mechanical engineering at UMass/Lowell, focusing on manufacturing engineering. He has had two books on concurrent engineering published by Van Nostrand Reinhold.

And now, updates from a few people (very few) who write regularly. **Jim Kester** is with CACI in Ohio, still working on radar, aircraft, and missile simulations in a multitude of languages. He says he gets "no sympathy at home" for his 60-hour workweeks and travel to St. Louis and Orlando. He is already looking forward to the "Big 30" reunion. . . .

**Matt Fichtenbaum** is still with Genrad. Notwithstanding his long-time background in board-tester hardware design, he has been working lately in instrumentation for telecommunications testing. He is currently developing software for digital test generation. He continues to play Scandinavian folk music and had a part in the Christmas Revels in Cambridge last year. Matt's wife, Judy, is an interpreter and guide for the Concord Museum. Their daughter, Rachel, a seventh grader, keeps him current in middle school math. . . . When William Nelson was running for an IEEE office a while ago he sent along some biographical notes. This time he sent a little more detail. He received his doctorate from Princeton and did a post-doc at Battelle Memorial Institute. After spending a few more years in academia, Bill joined Raytheon's Equipment Development Labs in 1978 as a senior scientist in the ring laser gyro program until he moved to GTE in 1984. He is a principal member of the technical staff in the Network Optoelectronics Department, working in the areas of semiconductor lasers, waveguide optical switching, and photonic integrated circuits. He has been a tireless volunteer in the IEEE Lasers and Electronics Optics Society, serving on multiple committees and organizing workshops that reached over 1,000 local engineers each year. . . . **Steve Weiss** writes that his older son, Jonathon, '93, has stayed at MIT in Information Systems as a software developer. Younger son, Jeremy, is now a sophomore at Cornell. Steve was found electronically by a friend from his Senior House days after 28 years of no contact. He and Bill Hester, '64, keep in touch regularly now, even though Bill is in New Zealand. Now I know many of you think Buffalo is even more remote than New Zealand, but e-mail goes everywhere, so keep in touch.—**Eleanore Klepser**, secretary, 84 Northledge Dr., Snyder NY 14226-4056; e-mail: <vsmitt66@ubvms.cc.buffalo.edu>

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**David Eisenhaure** and five colleagues from MIT's Draper Laboratory founded SatCon Technology Corp. in 1985. David serves as president of SatCon, which has successfully shifted away from a dependence on NASA and the Department of Defense, and now receives most of its revenues from commercial

contracts. SatCon, which went public in 1992, has rapidly growing revenues and has been profitable every year but one. It is one of a handful of companies developing electromagnetic devices and tiny sensors that David believes will find vast markets in the years ahead. SatCon's products are in use on the space shuttle and in satellites, and the company is developing commercial products that range from automobile parts to a new type of heart pump. The company has focused on an esoteric technology known as active motion-control systems. The technology has several advantages: it weighs less than traditional mechanical or hydraulic means, is smaller and cheaper, has fewer moving parts, and allows more precise control of movements. The technology has numerous applications; for example, SatCon has designed for the government a compressor with a spinning shaft that is suspended magnetically, so it needs no bearings and no lubricants. On its own, SatCon is designing silicon chips that contain spinning gyroscopes to sense motion and position.

**George Churionoff** presented a seminar titled, "Transforming Problems—How to Be Happy When You're Not!" in Boston last April. Following MIT and several additional years of study and teaching, George traveled to India, where he encountered the teachings of Tibetan Buddhism. Soon thereafter he began studying at Kopan Monastery in Nepal. He was ordained a novice monk in 1976 and a full monk in 1977. After three years' study and work at Manjushri Institute, England, he went to Lama Tzong Khapa Institute, Italy, where he has been studying and teaching since. George has translated several works from Tibetan into English. He has also undertaken and conducted many meditation retreats, and in 1992 made a very successful teaching tour of the USA.

**George Sacerdote** has been named VP of Mercer Management Consulting in Lexington, Mass. He was previously VP and managing director of Arthur D. Little, Inc. . . . **Don Davis** is now chairman of the math department at Lehigh University. His book, *The Nature and Power of Mathematics*, was published by Princeton University Press in 1993. In May 1994, Don finished 54th out of 3,500 runners in the Del Passatore 100 km race from Florence to Faenza, Italy; he was the official American male runner in that race, having won a 100-kilometer qualifying race in Washington, D.C. . . . **Al Falco** is still at Boeing as a lead design engineer on the Boeing 777. He and Colleen are buying a small farm in southwest Washington where they plan to retire in about five years.

**Roy Gamse** is now president of Earth Force, a new environmental group for kids, established by a five-year grant from the Pen Charitable Trusts. In their "Kids Choose Ballot," 146,000 kids voted, selecting the preservation of wildlife as the issue they most wanted to work on together. Roy expects their "Go Wild for Wildlife" campaign to result in over one million hours of "kid power" devoted to helping wildlife, chiefly by protecting, preserving, or creating wildlife habitat. . . . **Thomas Sharon** has been promoted to president and CEO of Electromagnetic Sciences, Inc., of Norcross, Ga. . . . **Joseph Levangie** has been named chairman of Food Integrated Technologies, Inc., in Brookline, Mass. He continues as CEO at JEL & Associates of Bedford, Mass.

**Mark Goldman** is a cardiologist at New-ton-Wellesley Hospital and is currently the director of the catheterization lab. After a two-year stint as the chairman of the executive committee of the medical staff, he was elected to the board of trustees. With "merger mania sweeping the hospital industry in Massachusetts," Mark feels that it's unsettling being at "ground zero." . . . **John Kassakian** was inducted into the National Academy of Engineering in October 1994, for his contributions to research, education, and industrial alliances in power electronics.

**Alan Hausrath** sent an interesting story entitled "The Mystery of the Ring." A few months ago he received word from Darlene Aigen of the MIT Alumni/ae Association that someone had turned in his class ring. Alan lost his class ring about 1970 or 1971 while on a rock climbing trip in New Hampshire. Unfortunately, he had taken the ring off for rock climbing and had placed it in the trunk of a friend's car. When he returned from climbing, he could not find the ring, in spite of extensive searching of the car and the dirt parking area. It was gone, and he later bought a new ring that he has worn to the present, almost never taking it off. More than two decades later someone found it and mailed it to the MIT Alumni/ae Association. It was mailed in Boston with no return address. Luckily Alan had his name engraved on it. He reports that when he received the ring in Boise "it still had a little dirt on it so it must have been pressed into the ground, stayed there all these years, and then come to the surface, probably as a result of construction or other earth movement. Maybe it turned up in someone's garden; I know that there has been a lot of subsequent suburbanization in the area." Alan would like to thank the finder of his ring, as well as Darlene of our Alumni/ae Association, by saying, "I AM SO HAPPY TO HAVE IT BACK!" That's a great story, Alan. My guess is that a kid with a metal detector found it—someone like our younger son, Tommy, who very much wanted and received a metal detector for his latest birthday.—**Sharlotte** and **Jim Swanson**, co-secretaries, 878 Hoffman Terr., Los Altos, CA 94024; <jswanson@lat.com>

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As I write this, we are enjoying a few days of shirtsleeves weather in early December. The only certainty is that it won't last!

This month, I have two items of recognition of members of our class to report, so I'll start with that. **Shirley Jackson**, who is currently a professor of physics at Rutgers University, has been nominated by President Clinton to serve as a commissioner of the U.S. Nuclear Regulatory Commission (NRC). Given our publication lead time, by the time you read this, she may well be confirmed and serving on the NRC. Shirley has taught at Rutgers since 1991. Prior to that, she worked for AT&T as a member of the theoretical physics research department, the solid state and quantum physics research department, and the optical physics research department. She is a member of the MIT Corporation, and has been a trustee of a number of other organizations.

**Avram Bar-Cohen**, professor and director, Thermodynamics and Heat Transfer Section,



Department of Mechanical Engineering, University of Minnesota, was recently awarded the American Society of Mechanical Engineers' (ASME) Edwin F. Church Medal "in recognition of contributions to engineering education, continuing education, and professional development on both national and international levels as an organizer and lecturer of short courses on the forefront of technology, and significant contributions to the ASME Board on professional development. Avram's research interests include the design, analysis, and optimization of thermal systems, with emphasis on the thermal packaging of electronic equipment.

Other than that, the mailbag has been light. **Bill Charles** is still trading stocks, options, and futures for his partnership. His son, Ian, is "having great fun learning to read and compute." He writes that "Kathleen and I have discovered windsurfing, and spent our 10th anniversary trying to look competent on Maui." . . . **Carson Strong** is a professor in the Department of Human Values and Ethics at the University of Tennessee College of Medicine. He and his wife, Peggy, live in Memphis and have two daughters, Ardis, 11, and Tara, 9. . . . **Steve Kanter** spent the 1993-94 year on sabbatical as a Fulbright Professor of Law at the University of Athens in Greece. He also returned to Kazakhstan, where he had helped to write the new constitution in 1992. He stepped down as Dean after eight years at Northwestern School of Law at Lewis and Clark College in Portland, Ore., "returning happily to the faculty." . . . **Michael Krashinsky** is still a professor of economics at the University of Toronto. He writes, "I survived (barely!) a year of administration as acting chair of my division, and am now back at what I love (teaching and research)." Is there a trend here? He also reported that his oldest son is in his third year at Queen's University, and his second son will go there next year.

As for us, Mike is now in Japan giving a paper on spectrum allocation in the millimeter wave region at an international Microwave Conference. I am due to join him in a few days, so we will end the year there.

Remember that we can be reached via Internet now, either at <marcus@fcc.gov> (for Mike) or at <ghm@nrc.gov> (for Gail).—**Gail and Mike Marcus**, secretaries, 8026 Cypress Grove Lane, Cabin John, MD 20818

plus help the class treasury a bit.

We have also heard from several people who want a "Class of 1969 25th Reunion Brass Rat Paperweight"—the kind that were handed out at the reunion. There are no more left, but in production runs of 10 or more we may be able to sell them for \$35 to \$45 each. Please write to me so that we can organize this discount production run.

When you read these notes it will be April, and I trust that the New Energy Age will by then be in full swing. Early that month I'll be off to give a co-written scientific paper at the Fifth International Conference on Cold Fusion in Monte Carlo, Monaco.

Those of you who are fully electronic can reach me or submit class notes at Compuserve <76570,2270>. Via the Internet, use this form: <76570.2270@compuserve.com>.—**Eugene F. Mallove**, secretary, 171 Woodhill-Hooksett Rd., Bow, NH 03304

## 70 25th Reunion

**Drs. Jesse Heines and Tim Gilmore** were the oldest competitors in the first annual swim team reunion last October. Jesse showed his form on the diving board, while Tim took on the competitors in the backstroke.

**Eric Clemons** is a full professor and the senior faculty member in information systems at Wharton. He is currently researching the impact of information technology on electronic securities markets, the balance of power in retail distribution, shopping in cyberspace, and the sociology of life on the Internet. His wife, Jean, loves their trips to London, while his five-year-old daughter, Julia, prefers their trips to Orlando.

**Tom Garrity** has become executive VP and CFO of PCS Health Systems, Inc., in Scottsdale, Ariz., the largest and fastest growing pharmacy benefit manager in the United States. Tom moved to PCS from his position as director of public policy planning and development for Eli Lilly and Co., after Lilly purchased PCS.

**Bill Kindel** writes that he, **Ken Sills**, and **Doug Wells**, are at the Open Software Foundation in Kendall Square. Bill and Doug do sponsored research and advanced develop-

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ment on operating systems and user interface technologies. Bill's wife, Dawn, teaches mathematics at Newbury College in Brookline. Their elder son, Bob, will graduate from MIT this June, and their younger son, Steve, is in his freshman year at Washington University in St. Louis. Bill is looking forward to the reunion.

**Jim Finder** announces that he and his wife, Maria Tassoni, had a son, Aaron, last October 7. Maria is involved in television production, and Jim is practicing patent, trademark, and copyright law in New York City. He hopes to see every one of the Dirty Dozen, AEPi70 soon.

**Kant Rao** tells us that he successfully dealt with brain cancer last year with the help of the Hershey Medical Center and that he is now better than ever.

We regret to say that **David Alperin** lost his fight for life last summer. David is survived by his wife, Peggy, and three sons—Brad, Keith, and Glenn.

If you have not returned your "bio" page for the reunion yearbook or your survey (it takes less than 20 minutes to complete), please get them in. See you soon!—**Greg and Karen Arenson**, secretaries, 125 W. 76th St., Apt. 2A, New York, NY 10023

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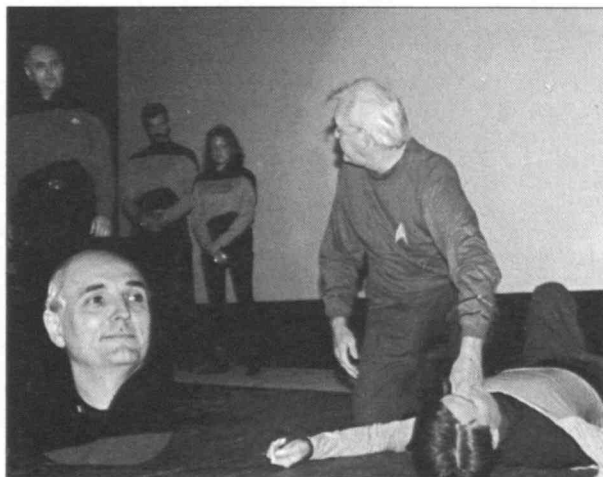
**Stan Tillotson** writes: "On the grounds that most people work about 40 years to support a family of four, I figure 20 years was plenty to support a family of two, so I retired to Florida."

. . . **Drew McDermett** has been chairman of the Yale Computer Science Department since 1991. He was just reappointed for 2 more years. . . . **Barney C. Black** writes: "I was laid off as a consultant to the Navy when the Hydrofoil Missile Squadron was decommissioned. Fortunately I was picked up by another company three weeks later, and am now working on Navy Hovercraft. My wife, Helena, and I have two boys, ages 6 and 4, and live in Alexandria, Va." . . . **Neal R. Satten**, MD, got an MBA at Wharton in 1994 and he is

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What is this strange silence? No notes from you guys this month again? OK, flood me with the news *next* month.

There may have been a misunderstanding about the distribution of *MIT Class of 1969 25th Reunion Yearbooks*. Those who attended the reunion received a copy with their \$35 registration fee. Some classmates thought the \$19.69 class dues entitled them to a reunion yearbook. We have a limited number of copies left (about 70) and encourage you to order one if you did not attend the reunion. The production cost of this thick book was over \$10. To get a copy, please send me a check for \$15.00, payable to "MIT Class of 1969." That will cover postage and production costs,



**Tom Pipal**, '71 (far left and inset), manager of training and development for Wiltel/LDDS in Tulsa, Okla., shaved his head to play Captain "Tom-Luc" Picard in a *Star Trek: The Next Generation* skit for United Way. The campaign raised \$1.5 million, the largest corporate gift in Oklahoma history.



medical director of the mid-Atlantic region for Medco Behavioral Corp.

**Thomas J. Pipal** is 1994 chairman of the Williams County United Way campaign. He had a kickoff skit based on *Star Trek: The Next Generation* for which he shaved his head to appear as Captain "Tom-Luc" Picard. The campaign raised \$1.5 million, the largest corporate gift in Oklahoma history. He continues as training and development manager for Wiltel/LDDS the 4th National Fiberoptic Telephone Co. . . . **DuBose Montgomery** has been named as a director of the Matrix Pharmaceutical, Inc. DuBose is also managing partner of Menlow Ventures. . . . **David A. Spear** is still flying. He is an aero research engineer at Pratt & Whitney. . . . **Ken Weisel** and his wife, Patricia Jenkins Weisel (Mills College '80), and their 4-year-old daughter, Lauren, have moved to Columbia, Mo. Ken is the general manager of the Missouri Joint Municipal Electric Utility

ing challenges from the quickly changing health care markets approaching New York. Her oldest son, Josh, was bar mitzvahed last year, and "the whole family shared that joy." . . . **Albert Yee** returned in September from his yearly wilderness trip (this time to Zion National Park). The trip was done with other Burton Third members **Gordon Shecket**, **Mark Goodrich**, '74, and **Jerry Shadix**. They toasted their undergraduate days at the 'Tute, and he sends greetings especially to former BT Bombers.

**Kathy Kram** has been a professor of organizational behavior at Boston University for 14 years. Her husband, Peter Yeager, is a professor of sociology at BU. Their son, Jason, is 7 1/2 and thriving—on school, karate, baseball, piano, and many good friends! "We are truly blessed." . . . **Lenny Sigal** notes the recent addition of Caroline (perhaps class of 2015), born on February 26, 1994, who joins Merissa (now 5). He is chief of rheumatology at

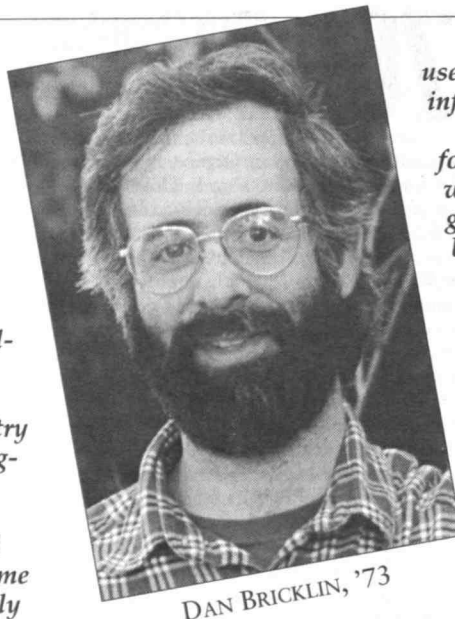
warm, spring-like weather, which is what will be upon us by the time you get to read these notes. **WRITE!**—Co-secretaries: **Wendy Elaine Erb**, 6001 Pelican Bay Blvd. #1001, Naples, FL 33963; **Dick Fletcher**, 135 West St., Braintree, MA 02184

# 73

An e-mail comes from **Ann Ezzell**, who transmits: "On October 14, 1994, **Gary Ezzell**, Course VIII, successfully defended his PhD dissertation in medical physics. (His wife, **Ann McBain Ezzell**, Course VII, heaved a big sigh of relief and started making plans for what to do with space that would be freed up in the living room with the return of the Silicon Graphics workstation to its rightful place.) Gary's topic was "Genetic and Geometric Optimization of Three Dimensional Radiation Therapy Treatment Planning."

**Joining 22 honorees (including Bill Gates, Ken Olsen, '50, and H. Ross Perot), Dan Bricklin, '73, president of Software Garden, Inc., Newton, Mass., and co-creator of VisiCalc, has been inducted into the Information Industry Hall of Fame by INFO-MART.**

**INFOMART, a business technology market center established to connect information-technology users and suppliers, honors industry innovators such as Bricklin for significant scientific, technological, and business contributions to the industry. After Bricklin conceived VisiCalc in the mid-1970s, it became one of the most popular and widely**



DAN BRICKLIN, '73

**used applications in the history of information processing.**

**In the 1980s, he developed a program for prototyping and simulating software, "Dan Bricklin's Demo Program," which was recognized as the best programming tool for 1986 by the Software Publishers Association. He won the award again in 1987 for a second version of the program.**

**More recently, Bricklin has developed "Dan Bricklin's Over-All Viewer," a tool for displaying data visually, published by Software Garden, and "Dan Bricklin's Demo-It!" for demonstrating software on Microsoft Windows, published by Lifeboat Publishing.**

Commission.

Don't forget to save your money for the June 1996 Class Reunion and the Class Gift. We need volunteers. Contact the Alumni/ae office.—**R. Hal Moorman**, secretary, P.O. Box 1808, Brenham, TX 77834-1808

# 72

**Allan T. Kirkpatrick** is now the associate department head of the Mechanical Engineering Department at Colorado State University. He is always looking for good undergraduate and graduate students. You can tell our production lead time, for as I write this (at Christmas time) there is still uncertainty whether there will ever be baseball again, but Allan wrote that "with the Colorado Rockies baseball team now on the field, the Red Sox box score is now the second box score checked in the morning." . . . **Phyllis Fishman Lantos** last year completed a multi-year audit by the government that ended favorably for Montefiore Medical Center where she is the VP for Financial Management Services. Now they are fac-

Robert Wood Johnson Medical School in New Brunswick, N.J. He also had the pleasure of attending **John Bissell's** marriage, which was also attended by **Steven Goldstein** and **R. Slaton Tuggle III**.

**Thomas Walker, Jr.**, and his wife, Sue, have lived in Pennington, N.J., (just outside of Princeton) since 1989 with their two sons, Tom (15) and Dan (13). He notes that Tom is "leaving me in the dust, taking differential calculus" (a course he dropped three times at MIT). As a reinsurance executive at American Re-Insurance Co., advanced spreadsheet is about the most he needs today. Dan's active in junior high sports, and Sue's working as a medical collections manager and a "many-talented volunteer while keeping us all in line." (She had been in the MIT News Office 1973-77). . . . **Aldrin Bean**, a professor of mechanical engineering at Duke, received the ACME Heat Transfer Memorial Award at its 1994 International Congress in Chicago.

That's all the news for now, but I hope that I will get more next time. I write this from New York City—it seems hardly like Christmas time, with trees blossoming and extremely

**David Moylan** recently co-wrote and edited the second edition of *Introduction to Clinical Radiation Oncology*, dealing with the management of cancer patients. He also scripted a screenplay entitled *Lazarol*, a fictional account of a search for a cure for lung cancer. . . . **William Stern** is the second MD to write; he is in private gastroenterology practice, has three children, is on the executive committee of the Montgomery County Medical Society, and is an associate clinical professor of medicine at the George Washington Medical Center.

**Peter Borden** and wife **Gale** are expecting their second child in January. Their daughter, **Julia** ('13), is almost three. Peter is currently VP for technology at High Yield Technology, a company he cofounded a decade ago. . . . In other news, **John Purbrick**, chief engineer at the Cambridge-based Project Genesis, reported successful completion of a microprocessor-based servo drive system for the Tech Nickel Plate model railroad turntable at Gifford City. . . . **George Smith** of the National Weather Service was awarded the Commerce Department's silver medal for work in river forecast-



ing and flood warning. He is a research hydrologist for NWS in Washington.

Write or e-mail:—Robert M.O. Sutton, Sr., secretary, "Chapel Hill", 7721 Churchill Ct., Marshall, VA 22115, e-mail: <sutton\_bob@prc.com>

# 74

Happy New Year! No, this is not an April Fool's joke, this column just gets written four months before you receive it! On to the news! . . . **Edward Ringel** continues practicing

pulmonary disease and sleep medicine in Waterville, Maine. It's really his excuse for playing outside (lake, cross-country skiing, etc.). He's also been doing Mac software development on the side (aren't we all surprised to hear that of a classmate!). Ed is grateful not to be in the larger urban areas, as are his peers. . . . **Jim Deucher** was recently selected for promotion to the rank of captain, U.S. Navy. He is assigned as a deputy manager at the Naval Sea Systems Command in Arlington, Va. . . . **Dennis Huber** writes to us from outside the beltway in Great Falls, Va. He is working for Perot Systems Corp. heading up "our" National Utilities Business Practice.

**John Appel** is doing what many of us are no doubt doing, mixing dairy farming and writing. He recently published a biography of Colombia's most important scientist, *Francisco Jose de Caldas: A Scientist At Work In Nueva Granada*, as part of the Transactions of the American Philosophical Society (Volume 84, Part 5, 1994). In 1976 John married Luz Alina Uruburu who was a special student at MIT (but weren't we all special?). They have two children, Venus Alma and John William. They live in Popayan, Colombia, where, besides the dairy farm, they have done some construction and have founded a hands-on museum. Typical career path for a physics major!

It's too late for Christmas, but you'll want to get this anyway! The ever-prolific **Peter Huber** has written a new book, *Orwell's Revenge: The 1984 Palimpsest*. I won't do this justice, but he basically re-wrote Orwell's epic in Orwell's style, "re-writing history" if you will, to change Orwell's prediction of technology as a force for political repression to one of freedom and enhanced creativity. In his spare time Peter is a senior fellow at the Manhattan Institute for Policy Research.

This month's editor is in the process of being promoted to director of marketing at Fisher Hamilton Scientific (we make the laboratory case-work and fume hoods many of you use). It was a long time coming, as I started here as a product manager way back in March (!). The family was a bit disappointed, as the promised cold and snow has been late in coming! If you're ever near Green Bay or Milwaukee (Two Rivers is in between) I would be disappointed if you didn't at least call.—Co-secretaries: **David Withee**, 3702 Adams St., Two Rivers, WI 54241; **Barry Nelson**, 65 Hillside Ave., West Newton, MA 02165, <bnelson@cspi.com>

## 75 20th Reunion

Greetings classmates. I have heard from several of you, so here goes. . . . **Matt Farber**

writes that Karmiya Jordan Farber was born April 13, 1994, joining her sister, Eve (2), and brother, Aaron (8). Matt was named "Humanitarian of the Year" by the Indiana Academy of Ophthalmology for his work on Project Orbis, the flying eye hospital, and is starting an ophthalmology clinic for the uninsured, in downtown Fort Wayne. . . . **Mike Kozinetz** had this to say, "Michelle and I have relocated to southeastern Thailand. I am working in the field engineering group on the construction of a grassroots refinery. It's an amazing and wonderful experience for us—we're adjusting to life here as it's a change from the USA, and we enjoy the uniqueness!"

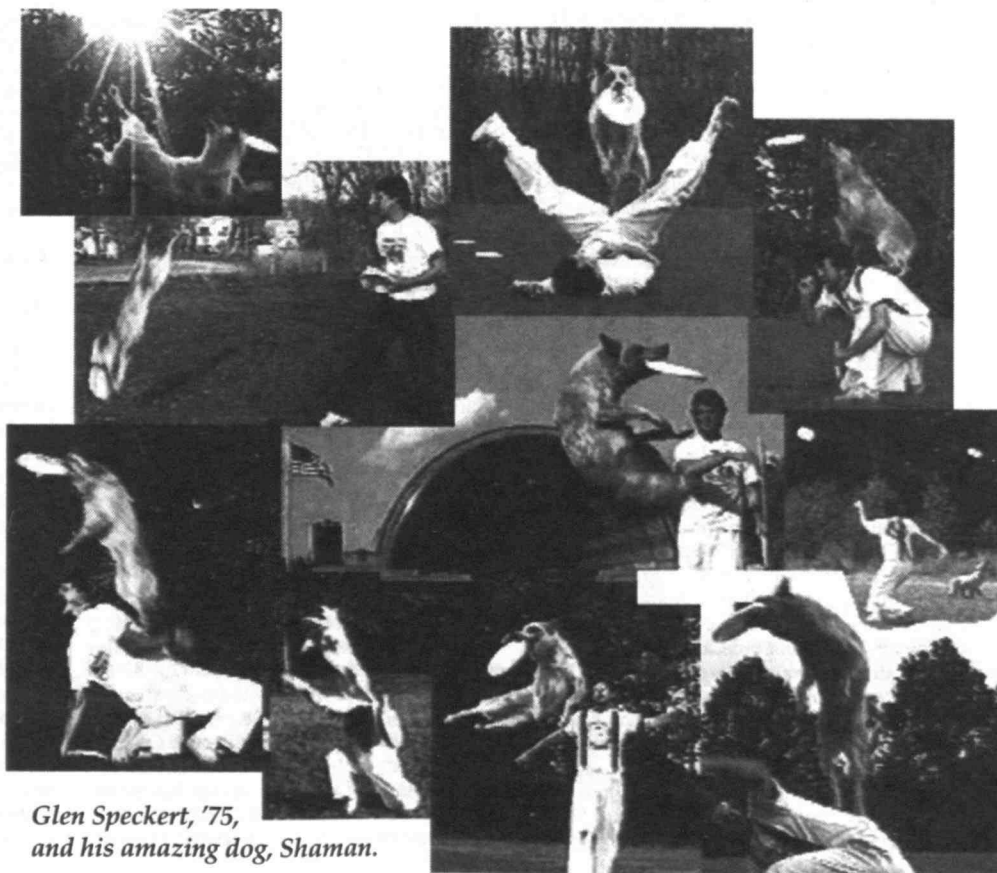
And the following nice note from **James Demers**: "I've been out of touch for just over a year, which corresponds to the time I've been caring for (and now chasing after) my daughter. Yes, it's true. Mary and I are the proud and exhausted parents of a 1-year-old (as of August 26, 1994), very active, very enthusiastic girl. Alexandra Danielle Demers promises to keep us exhausted (and proud) for years to come! She suffered a recent episode of toxic shock syndrome (extremely rare in infants), but thanks to superb care at Lenox Hill Hospital, she's fully recovered, and as active and cheerful as ever. We hope to see the old MacGregor Turkeys at the upcoming reunion!" . . . **Glen Speckert** is living in Melrose, Mass., and still playing frisbee—this time around competing with his canine, Shaman. They were the top novice team in the Northeast Region (13 states) in '93, and the top Mas-

## ClassNotes

sachusetts team in '94. They are accumulating freestyle tricks and leaps aplenty. Contact Glen via e-mail: <speckert@aol.com> (I hope I read that right) for a Quicktime movie clip.

**Joel T. Voelz** writes, "I am currently consulting to a variety of multimedia and online entertainment firms. Hopefully I am helping to construct some interesting "Vista Points" and rest areas along the "Information Highway." Besides enjoying my 10th year anniversary here in California and my new hobby of smoking fine cigars, we look forward to my wife becoming a partner at her law firm this year." . . . **Ralph A. Martin**, MD, accepted a position as a director of educational programs in the Department of Medicine at St. Francis Hospital and Medical Center, in Hartford, Conn. . . . **Charles J. Digate**, formerly president of Beyond, Inc., of Burlington, Mass., became president, CEO, and director of Mathsoft, Inc., of Cambridge, Mass., according to the October 28, 1994, *Wall Street Journal*.

**Dennis Crumpler**, XcelleNet, Inc.'s chairman and CEO, was named Entrepreneur of the Year in the high technology category, an award sponsored by Ernst & Young, Inc. Magazine, and Merrill Lynch. Crumpler, as well as other Southwest Regional finalists, was selected from a group of more than 100 outstanding entrepreneurs to vie for the national Entrepreneur of the Year title. This is the second consecutive year that Crumpler and XcelleNet have been recognized for business performance. Last year, Crumpler was named the 1992 High Technology Entrepreneur of the



Glen Speckert, '75,  
and his amazing dog, Shaman.



# Puzzle

Continued from Page MIT 62

distinct. As luck would have it, success comes swiftly, because there is an answer for  $A=5$ . BCDEFGHI is found to be 61728390. 6, 7, 8, 9, don't work. I note that BCDEFGHI turns out to be two digits short of a Wellesley phone number—perhaps an old girlfriend?

N/D 3. Martin Kalinski, a former Baker House colleague, asks a common question about palindromes. Kalinski reminds us that a palindrome is a positive integer that reads the same right to left as left to right. For example, 121 and 1331 are palindromes. Take a non-palindrome like 57 and add to its reverse:  $57+75=132$ . Keep going and get  $132+231=363$ , which is a palindrome. Will this procedure always yield a palindrome? Note that it is easy to find numbers that do not yield a palindrome after two applications of "adding the number to its reverse." The question is are there any numbers that never yield a palindrome?

I did not receive a real proof for this one. Matthew Fountain notes that the required lack of carries is less likely to occur for large numbers so that if a number does not become palindromic "soon," it is not likely to become one ever. Fountain applied the Kalinski procedure to the number 196 until the result exceeded 10,000 digits and no palindrome was produced. George Blondin asserts that 196 is the smallest number that *never* becomes palindromic, but did not submit a proof. Blondin also asserts that 12 other numbers under 1,000 never become a palindrome.

## Better Late Than Never

M/J 3. Charles Wampler writes "The 'trepidation' you mention in publishing the solution to M/J 3 is well-founded, as I imagine you are going to get a few comments on this one!" Indeed, I did. Richard Hess writes "Your solution was correct but I believe not

for the problem Bob [High] intended. I believe he meant to [have the ball roll on] a horizontal circle as opposed to the vertical case you solved". I agree with Hess and must confess that I never thought of the horizontal case. Finally, among other correct solutions to High's intended problem, came the following from Naoaki Takashima.

The performance of a billiard ball rolling around a circle without slipping and twisting is exactly identical to that of a rolling cone with proper peak angle as shown in Figure 1. Figure 2 shows Nob Yoshigahara's similar model of a rolling umbrella instead of a rolling cone. As shown in Figure 3, the trace of contact on the ball is a circle whose diameter is  $1/\sqrt{2}$  times of the diameter of the ball. Thus  $\sqrt{2}$  revolutions of the ball around the axis CO is made when the ball is returned to the original position after rolling around the circle, and the location of black dot became  $P_1$  (or  $P_1'$ ).

The black dot is never returned to the initial position ( $P_0$ ) after any number of times of rolling around the circle!

## Other Responders

Responses have also been received from W. Anderson, W. Deane, S. Feldman, M. Fountain, R. Hendrick, A. Julian, J. Keilin, J. Miller, L. Nissim, G. Orenstein, A. Orvistein, K. Rosato, E. Sard, and M. Wand.

## Proposer's Solution to Speed Problem

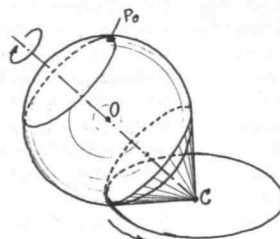
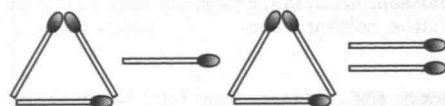


Fig. 1 Concept of rolling ball

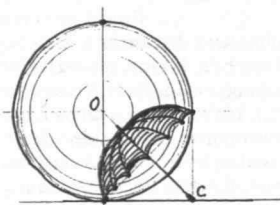


Fig. 2 Nob's umbrella model

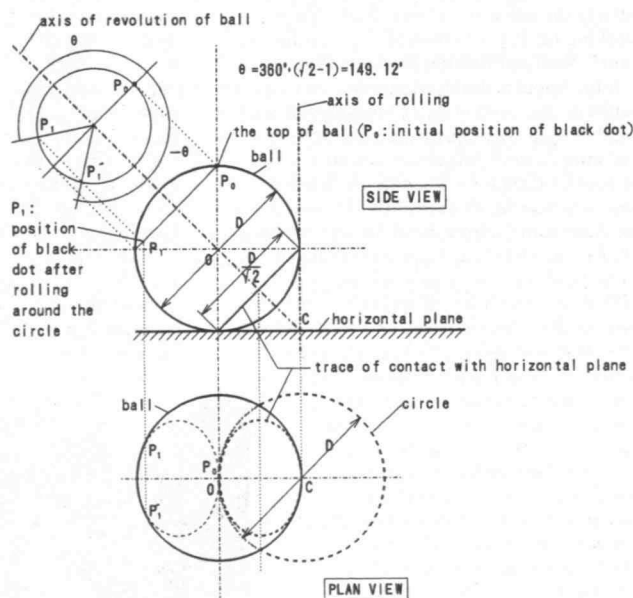


Fig. 3

Year by the Georgia-based Business and Technology Alliance.

I received a much welcome letter from Douglas Falkenburg: "I am running IMTI Systems, the industry leader in Loss Control and Safety Engineering software for the insurance industry. Founded by myself in 1979, we now have 15 people and count most major property and casualty insurers as our clients. And our field software keeps workers safe and protects buildings from fire and other disasters. Wife Cheryl coded a new arrival last August, Grant Evan—gives me a backup heir apparent should his older brother, Julian (29 months), abdicate. In addition, I am the proud father of a four-month old Harley 1200 Sportster, lotsa chrome and very loud pipes. Can a tattoo be far behind? And still hacking around with folk and country guitar."

That's all for now. Hope to see you all at the reunion.—Jennifer Gordon, secretary, 18 Montgomery Pl., Brooklyn, NY 11215

# 76

We are fortunate this month to have a nice assortment of news, both via post and e-mail. Please continue to write.

Lee Silberman writes, "In July, my wife and I adopted a newborn daughter, Clara Michelle. Our 8-year-old son is upset that we did not bring home an older brother. As we only had 24 hours notice before getting Clara, our summer was very hectic and lots of fun. For anyone who is thinking of adopting, do not believe the stories that healthy babies are hard to get. All you need to do is find a good agency, fill out

one ton of paperwork, and wait patiently for less than 18 months. (Emphasis, Lee's.)" . . . Rachel Powsner is "working in nuclear medicine in Boston. My husband, Ronald Gurrera, and I just celebrated our eighth wedding anniversary." . . . Todd Mojesky now lives in Canada, and writes, "The mountains are amazing, and the oil industry here in Canada isn't bad either."

From Michael Baumann: "Still in Washington, D.C., working for an economic consulting firm, Economists, Inc. While who is 'in' affects my work, fortunately it doesn't effect my employment. I've spent the past two years dealing with cable-rate reregulation. Who knows, the new Congress may bring rate rederegulation." . . . Fred Tsuchiya is "at MTS Systems still (16th year). Other alumni at MTS George Butzow, '51, retired as chairman of



MTS; Frank Conati, Sr., SM '77, recently married; Joe Albright is now in his 17th year at MTS. Give us a call for your needs in advanced control and high performance testing systems!"

Deborah Stein Sharpe notes, "Kids are wonderful, work is great, husband Jim gets better every year. Life is good. We are blessed."... Jack Stevens has finally written: "I have been married for four years now. My wife, Arlene, and I are pleased with our new (7-month-old) son, Daniel. Even with the resulting loss of sleep and free time, I still have been able to visit the MITSFS regularly, where I actually said to an undergraduate: 'Don't tell me what to do. I've been an MITSFS Volunteer Librarian longer than you've been alive!' I still can't believe that it was true!"... Jon Sass laconically notes that his "kids are getting older (3 and 8 now). Still teaching high school—alternative program. Not much new. Is this a sign of middle age?"... From Michael Kotlarchyk: "Currently professor of physics at RIT in Rochester, NY. Married, with two children. Returned to Nuclear Engineering Department at MIT last spring semester to teach 22.113 (Nuclear and Atomic Collision Phenomena) during sabbatical leave. That time was also spent working on the late stages of a textbook with Professor S.H. Chen to be published late in 1994."... Jack Chaney "enjoyed seeing Marcel Gaudreau, '74, and Larry Michaels while in Boston on business. My first time back in eight years. Marcel is president of a small firm with some promising products for electrical power. Larry is a globe-trotting consultant for airlines, especially European. I am still employed with Corning as an engineering manager, as well as a harried father and amateur cyclist."

From Bob Chen, "I've been putting my TPP training to good use as project scientist for the Socioeconomic Data and Applications Center, one of the NASA Earth Observing System data centers. We're working to develop applications of integrated social and natural science data in policy making concerned with global climate change. Meridith now works half-time at CIESIN on environmental health issues. Bryce just turned 7 and enjoys second grade; Kathryn is about to reach the terror-ific age of 2."... From Diana Dickinson: "Several years ago I went back to school and got an MEd from UMass/Lowell and have spent the last two and a half years teaching science to middle and high school students here in (too sunny) California. It's fun and gives a whole new light on 'today's youth.' We move next month to Seattle (not as sunny), where I expect I'll teach high school again but don't have a job as of yet. My daughter, Stacia, is now 9 and currently designing a space station as a school project. My son, Scott (8), spends his time on building robots."... From Robert Sand: "It's been at least a year since I sent any news. I'm still one of the principal scientists at North Star Research here in Albuquerque, N.M. We've managed to keep really busy with government contracts and a product line of high-voltage equipment. We're in the Thomas Reg. and advertise in a few other EE trade journals. My wife, Kathy, and I have been married 18 years now and manage to travel as much as we can—a cruise through the Panama Canal, backpacking in Wyoming, and business trips to San Diego. Kath is working on a PhD at

the local university while teaching half-time. Daughter Erica (15) is in high school and would love to generate her own tales of romping around Cambridge/Boston while attending Tech in a few years. Son Matt (12) represented New Mexico in the Tae Kwon Do Karate Junior Olympics last July in Chicago. In fact, we're all taking karate right now to stay in shape."

Alan Dubin has sent via e-mail "greetings from Belgium," but no other news. Hopefully, this will be rectified by the next issue of the Notes. . . . Steven Spura writes: "I have been working in Rhode Island for the last 14 years. I have a daughter who celebrated her bat mitzvah last January. I completed a divorce from my first wife also about one year ago. I am now engaged to Susan Altman from around R.I. I have participated in many MIT alumni/ae activities here in the Bay State. Our group puts on one, sometimes two, meetings a year that are attended by about 20 people. Marty Billett, '48, has consistently held the club together and found remarkable speakers for each event. In addition to my regular job as VP for engineering with a job-shop finishing company called Providence Metallizing, I also do consulting and sales of PCs at a company called HyperQube Co. "

From Rick Ottolini: "I have been a geophysicist at this Southern California company [Unocal Corp.] for four years now, after a long stint at Stanford/Silicon Valley."... From Gail Rubin Walker: "Not much is new since I last wrote. My kids, Rebecca (6.5) and Danny (4.5), are fine. I am still in the divorce process (separated over a year now), and still working at Belmont Research in Cambridge."

Shaun Coughlin has been elected to the board of directors of COR Therapeutics. He is one of seven directors. COR is a NASDAQ-traded company dedicated to the discovery, development, and commercialization of novel pharmaceutical products for the treatment of and prevention of severe cardiovascular diseases, and has one drug, Integrelin, in Phase III clinical trials. Shaun is an associate professor of medicine at UC/San Francisco, and has served in various capacities at the Howard Hughes Medical Institute as well. Shaun is a co-founder of COR and has been a scientific advisor to COR since its start-up. . . . Michael Gilman is now the VP for research at ARIAD Pharmaceuticals in Cambridge.

Odds and Ends: Christine Santos is now working at Simmons College. I have no other details.

As for your secretary, he continues to plug along with a combination of trading and his turnkey computer business (VAR and Systems Integration). Each provides enjoyable and frustrating moments. On the trading side, volatility in interest rates and the dollar continues unabated—a speculator's dream, or nightmare, depending on which side of the market one finds oneself in the morning upon arising! The computer business side has its frustrations inasmuch as I have available a huge amount of superb technology, and ongoing problems selling it. Perhaps it is a hallmark of going to the 'Tute, being far ahead of the curve, with the problems this seems to entail.

Please continue to write, and especially, to e-mail. Thanks to e-mail, we have a steadier supply of news, which means a) a regular column, and b) a long column!—Arthur J. Carp, secretary, Quantalytics, Inc., 220 Henley Rd.,

# ClassNotes

Woodmere, NY 11598-2623; tel: (516) 295-3632; fax: (516) 295-3230; e-mail: <quantaly@aol.com>

## 77

Welcome to spring, classmates! Your news has been scarce, therefore so has this column. However, your generosity to the Alumni/ae Fund has resulted in a large quantity of news blurbs this month. . . . From Frank C. Richardson we learn that his daughter, Karen Mary Richardson, was born January 14, 1994. . . . Eric Lindstrom wrote to say that he is presently U.S. Program Scientist for the World Ocean Circulation Experiment. Eric lives in Derwood, Mass., and can be reached by e-mail at <woce@access.digex.net>. . . . Eric Egan recently formed Egan & Associates, a new Washington, D.C., law firm specializing in energy and environmental litigation. His new firm represents clients from 11 countries in matters before the Department of Energy, the Nuclear Regulatory Commission, the Federal Energy Regulatory Commission, and in civil and rate litigation.

Matthew Sherman is presently director of clinical research at Genetics Institute. He is enjoying the growing field of biotechnology as well as his growing family—now three children, all girls, Rachel, Jennifer, and Julia. . . . Michael J. Cady is still active in the New England construction industry as a software consultant to contractors. He is also the executive director of the Mason Contractors Association of Massachusetts. He writes, "My terrific wife of 17 years, Heidi, and I are constantly busy raising two boys (ages 1 and 3). This is a greater challenge than anything I've done in my professional career!" . . . After 14 years at one job, Todd Glickman has finally made a change! He's now the assistant executive director of the American Meteorological Society. Headquarters is at 45 Beacon St. in Boston, so he gets to commute in via the "T". He informs us that his fellow New Yorkers can still catch his weather broadcasts one weekend per month on WCBS News-Radio 88.

There is more news that's fit to print, but I'm holding on to some of it for next issue, just in case you, dear classmates, fail to swamp my mailbox/e-mail. Looking forward, as always, to hearing from you. Write to Ninamarie Maragioglio, secretary, 9727 Stipp St., Burke, VA 22015

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Please send news for this column to: Jim Bidigare, secretary, 9095 North Street Rd. NW, Newark, OH 43055-9535, (614) 745-2676, fax: (614) 745-5648

## 79

I regret to announce the death of Hank D'Amato on November 5, 1994. For the last four years, Hank was a research physicist with United Technologies in East Hartford,



Conn., specializing in laser and fiber optics. Previously, he worked at Perkin-Elmer Co. in Danbury, Conn. Hank received a PhD in 1987 from the University of California at Berkeley. Our sincere sympathies go to Hank's family.

I had a lovely chat recently with **Marla Eglowstein**, who called from her home in Loudonville, N.Y., near Albany. Marla is a high-risk obstetrician and has just opened her own office. Previously she was on the faculty of Albany Medical College, which is part of Union College. Marla and her husband, Eliot Rich, are the parents of 6-year old son Nathan and 1-year-old daughter Davi. Eliot is working toward a doctorate in information science. . . . Further upstate, in Rochester, N.Y., Susan Ann Silverstein, '80, and her husband, Kenneth Seiji Shiotani, announce the birth of their new son, Noah Ethan Shiotani, last August 31. Susan works with Monroe County Legal Assistance Corp., a legal services program representing poor people in civil matters. She is now a senior attorney, specializing in housing and disability issues and federal litigation. In January 1993, she was appointed by then-Secretary of HUD Jack Kemp to serve on an advisory task force to Congress and HUD, which involved working in Washington, D.C., on a regular basis. Susan and Kenneth are also the parents of 6-year-old Elliott Benjamin Shiotani, who is especially gifted in math-related cognitive skills and wants to be a scientist. Elliott's friends include the offspring of two other MIT grads, Clarke Kimberly (Kim) Eastman, '80, and Naomi Pless. Naomi is a family doctor and is the mother of Lilah Crew-Pless, who is in kindergarten with Elliott. By the way, Susan is interested in hearing from Carol Hsu, Kathleen Williams, '80, and "other course XVIII types." . . . Drahomir (Mike) Lazar, '78, was planning at press time to retire from the Navy this past December after 15 years. His wife Martha works as a software engineer at Qualcomm, Inc., in San Diego, so he is looking for work there. He has also been active in the local chapter of the American Institute of Aeronautics and Astronautics and is currently its assistant public policy officer.

After two years in the D.C. area, **Todd Peltzer** and his family have been sent by the Navy back to Hawaii again (his fourth tour in the islands). He has been assigned to the staff of the commander-in-chief, U.S. Pacific Fleet, for the next three years. Since his wife, Sandy, is from Hawaii, they are happy about being close to family again. Their daughter, Nicole, will turn three years old soon. Todd writes, "I'm convinced that two-year-olds have been the source of inspiration for perpetual motion machines." . . . **Barbara Biber** ran into **Audrey Greenhill Lones** and **Cindy Reidy**, '80, at the recent MIT Club of Maine dinner, where they enjoyed an interesting presentation about great MIT hacks. Barbara's two-year old son, Peter, "is providing us with lots of entertainment, reminding us of how much 'neat stuff' there is in the world!"

**Laura (Rees) Willett** and **Bob Willett** relied on Northwest Airlines rather than the stork to bring them son James from Seoul, Korea, in January 1994. Laura works part-time in teaching and administration at Robert Wood Johnson, New Jersey's state medical school. Bob continues solid-state physics research at Bell Labs. . . . **Tom Smith** is a market planner at Cummins Engine Co. in Columbus, Ind. His wife, Yang Xu, whom he met while in busi-

ness school at Yale, also works at Cummins, but in international finance. They are awaiting the arrival of their first child. They hope to hear from other alumni/ae in their area. . . . **Jordan Kreidberg** had an eventful 12 months: First, he and his wife, Debbie, went trekking in Nepal near Mt. Everest, climbing all 20,300 feet of Island Peak. Then Jordan became an assistant professor at Harvard Medical School, and is setting up a lab at Children's Hospital to continue his studies on kidney development. To top it all off, on October 2, they became parents of Caroline. The Kreidbergs live in Wayland, Mass.

Class agent **Rick Kovalcik** has been with Stratus Computer in Marlboro, Mass., for just over 10 years. He was recently promoted to senior technical consultant in worldwide technical operations. He spends 70 to 80 days a year on the road visiting customers. . . . A recent article in the *Financial Times* quoted **Eran Broshy**, who is a VP of the Boston Consulting Group in New York. . . . Nothing new with your faithful secretary, except that I've got tickets tonight to see Glenn Close in *Sunset Boulevard*. I hope it's worth all the hype.—**Sharon Lowenheim**, secretary, 98-30 67 Ave., Apt. 6E, Forest Hills, NY 11374

## 80 15th Reunion

Just a few short notes this month. . . . **Richard Tucker** is an associate department head for artificial intelligence at MITRE in McLean, Va. . . . **Theresa Ravese** is group financial officer for the U.S. detergents business of the Lever Brothers Co. . . . **Arthur Hu** is living with his wife and two boys in Redwood, Wash., where he grew up. . . . From Houston, Tex., **Matthew Steele** writes he is still working for Texaco. His wife, Randi, is now a stay-at-home mother for their two sons, Joshua (5) and Norman (3 1/2). At Texaco, Matthew's primary concentration is on Texaco's credit card business and strategies, which is a very active part of the oil industry these days. He also notes that they survived the October 1994 flood in Kingwood! . . . **Harvey Alcabes** and his wife, Ellen Stromberg, announced the birth of their second child, Jonathan Michael Alcabes, on November 28, 1994. Big sister, Sarah (3), is very excited about her baby brother. The family is living in Belmont, Calif. (San Francisco area), where Harvey works as a developer liaison at Kaleida Labs, a joint venture of Apple Computer and IBM, which is developing multimedia software.

Please send your classnotes to: **Kim Zaugg**, secretary, 549 Fairfield Rd., Canton, MI 48188, (313) 981-1785, <vayda@erim.org>

## 81

After long silence . . . The cards, letters and personal accounts have finally started to come in. Now that the pump's been primed, I'm sure you aren't going to be so reticent in the future, now are you? Anyway, here's the latest:

**Memory recovered** . . . **Marc Chelemer** can't remember the last time he wrote to this column, so he's got lots to talk about. He's taken a new job, after a stint as scheduling manager at ThermalKEM in Rock Hill, S.C. Presently

Marc's an equity analyst following the environmental industry for Sanford C. Bernstein & Co., a Wall Street research and management firm. He's been at it for a year or so and loves it. Marc, wife and daughter Micaela (3), live in suburban Mahwah, N.J., where the gardening is organic and the house is vintage 1913. We are further informed that Micaela is already showing MIT potential.

Marc relays news about classmates. **Marc Stutman** was living in the San Francisco area, working for Crocker Bank in the field of fault-tolerant computer architectures before starting his own firm doing the same thing. But the lure of the East was too great, and so Marc and brother Steve formed a new firm, Metriplex Systems, in Cambridge. He's happy to be back in the Boston area. . . . **Ephraim Fuchs** attended school at the University of Pennsylvania, followed by a residency in immunology at Johns Hopkins. After that, it was three years of immunology research at the National Institutes of Health. Presently, Ephraim is back at Johns Hopkins, practicing in oncology. . . . **Charles Dennison** headed for Colorado after graduation to work for Hewlett-Packard. After a series of adventures, Charles is now manager of process development for DRAMs and SRAMs at Micron Technologies in Boise, Idaho. Charles has been happily married for about two years now, and enjoys living in the mountains.

**London calling** . . . **Jonathan Colton** sent a postcard from Imperial College in London, UK, where he's now on sabbatical in the Department of Chemical Engineering. Imperial College is near Hyde Park, which is great for jogging and playing football (that's real U.S.-style football, not that other game they play in short pants). Jon's wife, Rachel Graber Colton, '87, is also on sabbatical, studying for a degree in international accounting and finance at the London School of Economics. Back in the States, Jon is an associate professor of mechanical engineering at Georgia Tech, where he holds a Woodruff Faculty Fellowship (sort of like a mini-"chair"). Jon's research is in design and manufacturing.

**Hey, Abbott!** . . . We hear from Evanston, Ill., that **Robert "Chip" Hance IV** is now working in the Diagnostic Division of Abbott Laboratories as a marketing manager. Chip got married last year after meeting his wife in Chicago, and they honeymooned in Hawaii.

**The East is green** . . . Kudos to **Ralph Braccio** for receiving a special appointment to the World Bank to promote and coordinate environmental investments in Central and Eastern Europe. His new position was created to support the effects of the U.S. and several Western European countries resulting from commitments made at the 1993 environmental ministerial conference in Lucerne, Switzerland. Ralph can be reached at the World Bank by e-mail at <rbraccio@worldbank.org>.

**Light sleeper** . . . **David Kazdan** reports that he's "seeing the light at the end of the tunnel" as he completes his residency in anesthesiology at University Hospital in Cleveland, Ohio, and that what he craves most these days is sleep!

**Bound for Belgium** . . . **Bill Flarsheim** has been in Deridder, La., for going on five years now. He's the proud father of Philip (5), Sarah (2), and George (10 months). Bill's a process engineer with Westvaco Corp., which makes resins for printing links. He's been involved with two major expansions in Deridder, and





## Dale Stuart, Free-fall Queen—the Sky's the Limit

**S**he flies through the air with the greatest of ease, the daring young woman without a trapeze! Dale Stuart, '82, Nastassja Kinski's skydiving stunt double in the film *Terminal Velocity*, makes it look easy as she strikes a pose high above Lake Elsinore in southern California.

Not long ago, with a doctorate in aero & astro from MIT, Stuart was a project manager designing spacecraft systems. But now she has traded her engineering profession for one in free-fall performance. Late last year, she became the first five-time, undefeated Women's Aerial Freestyle

World Champion. To compete, she leaps from a plane at 13,000 feet and, before pulling her parachute, performs a routine of flips, pirouettes, and poses. Over nine years, she has made about 4,000 jumps and continues to invent new freestyle moves and routines. □

has also been shuttling to Belgium, where the company is considering setting up a new plant. If the plant is built, it looks like Bill will transplant himself over there as well.

We also have news notes from some of our more frequent contributors (thanks, and keep it up!). Last time we heard from **Victor Miller**, he was working as a systems engineer for Loral Electronics in Yonkers, N.Y. Victor has now received his professional engineering license, and is continuing his success at Loral.

*Still kicking . . . Don Jones* and wife Ruth (Sloan '87) are still watching, coaching, and playing soccer in their spare time. Don reports that he's a project engineer at LeBlond Makino Machine Tool Co. in Mason, Ohio, while Ruth's working for Procter & Gamble. They can be reached through America Online <rigeljones@aol.com>.

*Big Wheel, Part IV . . . Steve Levin* has been working on the 1995 Schwinn, which promise to be "really special." Some timely design assistance came from **John Castellano** as well. Steve's also happy to announce the arrival this past September of new daughter

Rebecca Ann, joining sister Jamie, now 21 months old.

*Back in the States . . . Debye Meadows Galaska* has returned from a tour of duty on Okinawa and is now living in San Antonio, Tex. She's still a bioenvironmental engineer with the Air Force. Debye and husband Patrick have their hands, and house, full with five (note the recount—not six as previously conjectured!) children: baby Joanna Margaret, Noah, Aaron, Daniel, and Rachel.

As a final note, I am informed by our class president/class agent, **Marc Chelemer** that a lot more progress needs to be made in the Class of '81 Room 10-280 renovation project. Presently we're only about 20 percent of the way to completion of our mission. That means we need your help! Suggestion: next time you contribute to the Institute, change the designation for at least a part of your gift to the class project. Come on—we know you want to see your names on the wall for all those future students to see.—**Mike Gerardi**, secretary, 3372 Olive St., Huntington Park, CA 90255, (213) 587-2929 (h), (310) 553-5050 (w)

# 82

**Alan Wimmergren** has left the shrinking aerospace industry for brighter prospects at TRW Information Systems & Services. . . **Yee-Ning Chan** is a senior packaging engineer

with Northern Telecom in Ottawa, Ont. His extended bachelorhood ended on September 9, 1994, culminating many years of global "eigensearch" that took him as far as Singapore, Hong Kong, and Macali. He and his wife, Soo Kiak Loy, honeymooned in Alaska. . . **Bennett Ruderter** is a cardiologist in Memphis. . . **Peter Rogers** achieved the rank of major in August along with classmate **Bryan Fortson**. He bumped into fellow Detachment 365 alum, Major Howard Blakeslee, '81. Howard has just been reassigned to Space and Missile Systems Center at Los Angeles Air Force Base.

As for me: After an intense one-hour labor Derek Vincent Fanucci was born into his father's arms on December 12, 1994. He weighed in at 9 pounds, 10 ounces. We planned a home birth and the midwife arrived



about 5 minutes after he was born.—Helen (Fray) Fanucci, 502 Valley Forge Way, Campbell, CA 95008; <fangroup@aol.com>

# 83

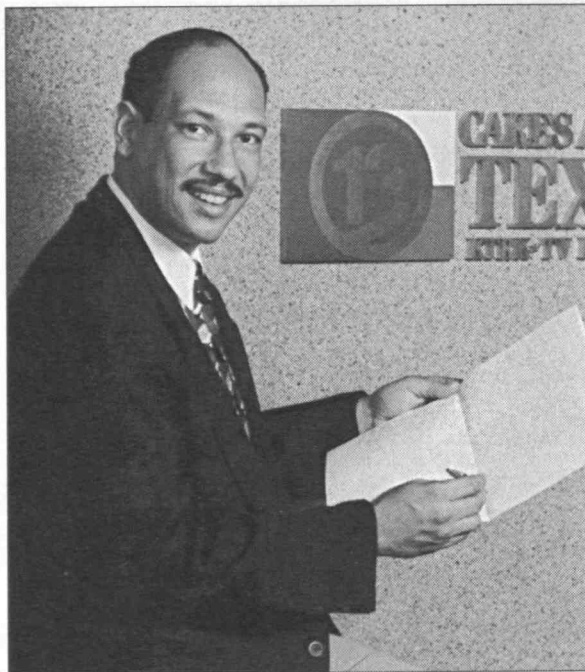
Babies dominate the news this month. Randy Schweickart and Michelle Heng, '84, announce their newest addition, Ian

Randolph Whitfield Schweickart, born September 16, 1994, at 10 pounds, 14.4 ounces. Ian joins sisters Ashley, 9 and Marielle, 5, at the Schweickart's Houston home. Randy works with McDonnell-Douglas at the Bioreactor at Johnson Space Center. Michelle is assistant professor at Baylor in the Department of Neonatology. . . . John and Susan Piotti, as mentioned in our last column, celebrated the birth of their daughter, Anna, on August 27, 1994.

Norman Hunt and Fran Sessa announce the birth of Grayson Reid Sessa, on November 25, 1994, at 7 pounds, 4 ounces. . . . In December 1993, Melissa Miller Pimenta remarried Bitá Pimenta, who escorted Melissa to our 10th Reunion. They had a beautiful baby girl named Christina Melissa in May 1994. Following a three-month maternity leave from American Express, Melissa was laid off two weeks after returning to work, so she is taking advantage of the opportunity to enjoy being a full-time mom. . . . John Von Zelowitz is busy working on Japanese type characters for Adobe in San Francisco and working on an old house that he bought in the city. There is a rumor that John is making a recording with his band, The Rip Offs; more on their debut in a later column. . . . Henry Lin has settled in Spokane, Wash. He practices as an orthopedic surgeon with a sub-specialty interest in surgery of the hand and wrist.

T.F. Tse was recently promoted to managing consultant in EDS Management Consulting Service, Cambridge, Mass. . . . Tricia Smith writes from Carlisle, Mass., that after eight years at Sasaki Associates, she has formed a WBE consulting practice which teams with architectural and engineering design firms. Tricia provides computer-based site planning, civil engineering design and analysis services as well as computer network, CADD, GIS and other application support. By joining project teams, Tricia helps clients better leverage computer-based technologies. . . . Arthur Vasen is a physician in the Department of Orthopedics at University Hospital in Cleveland, Ohio. . . . John Palevich is at Apple Computer in Cupertino, Calif. . . . Levent Ozcolak is a supervising design engineer at Exar Corp. in San Jose. . . . Dawn Jegley is an aerospace engineer at Langley Research Center in Hampton, Va. . . . Allen Frechter is a senior consultant at Lochridge and Co. in Boston.

Please keep those cards and letters coming.—Jonathan M. Goldstein, secretary, c/o TA Associates, High Street Tower, 125 High St., Suite 2500, Boston, MA 02110, Fax: (617) 574-6728



**Whoever says you can't succeed with your head in the clouds doesn't know Gene Norman, '82. He's the new weather-caster for KTRK-TV, Houston. Before joining 13 Eyewitness News, Norman was a software engineer with UNISYS in Houston. UNISYS is contracted by NASA to support National Weather Service forecasters at the Johnson Space Center as they advise space shuttle flight controllers on weather conditions. While at UNISYS, Norman developed and maintained interactive weather-data gathering and display software used to support the space shuttle operations. He prepared weather briefings and monitored the real-time weather data during shuttle launches and landings.**

# 84

Just got back from the feeding trough after two weeks of constant gorging at holiday parties. Back at work the first day and my coworker says to me, "So, it looks like you've been eating a bit, huh?" So I thought I'd get myself back into a good mood by reporting all the great things that I've heard from all my MIT friends!

It had to happen: I finally ran into a classmate on the job! I saw Pat Antaki at the Western Cable Show in Anaheim, Calif., recently. He dragged me away from a display of the fastest car in the world (432 mph, driven by Al Teague) to tell me about his entrepreneurial successes. Several years ago Pat started his own company, AnTel, to do telecommunications electronics consulting. He has recently parlayed that into a new venture called One MultiMedia, Inc., to design and build video servers for interactive television. Pat's planning to go public. Save a few spots for us when you hit the big time, Pat!

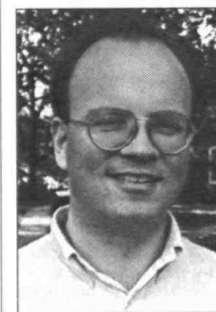
In the same vein, Arunas Chesonis has just been promoted to COO of ACC Corp. in Rochester, N.Y. He is retaining his titles of president and CEO of that company. And Steve Dubnik has been promoted to CEO of a subsidiary, ACC TelEnterprises Ltd. He and his wife, Claire, will relocate to Toronto in connection with the promotion.

Jerry Smith wrote me a very long and incredible tale of his misadventures across the country this year. I shall synopsise: "Jen and I took a road trip to Dinosaur National Monument at the Colorado/Utah border at the end of summer. While we were there we signed up for a whitewater rafting trip on the Green River. Cruising down the river in Dino-Land, I felt we were already in the Land of the Lost. The views of the canyon were intense. Along the way we stopped to take a dip in a warm spring. Two of the rafters didn't speak English and had a hard time following the guide's commands; they tended to stop paddling in the middle of the rapids (a no-no). But we all survived anyway. We got off the river in time to stop by the visitor center. Before zoning for the night, we got to ogle some dino-bones. A zillion bones are exposed on this one rock face, which is enclosed by the building. On the way back home we took a drive on a scenic highway that led to several lookouts over the magnificent canyons dug by the Yampa and Green rivers. The whole trip was excellent." (More to follow in another issue.)

Kathy Takayama has some interesting news to report. "After surviving three brutal (-60° F) winters in Wisconsin as a postdoctoral fellow at UW/Madison, I've decided to head for warmer climes. I will be moving to Sydney, Australia, to join the School of Microbiology and Immunology at the University of New South Wales this December. So while my Midwestern friends are digging themselves out of three feet of snow, I shall be enjoy-

ing the warm tropical sun, surf, and great Barrier Reef. Everyone is more than welcome to visit! Come for the 2000 Summer Olympics!"

Doremy Tong writes, "I'm living in Germany and enjoying Europe, but I'm still looking for a good job!" . . . Another Class of '84



**Mark Pundurs**

member has been passed the torch. Mark Pundurs has been named visiting assistant professor of physics at Guilford College in Greensboro, N.C. Mark received a PhD in physics from Illinois Institute of Technology in 1990. And a brief update on yours truly. I just got through the traumatic experience of moving. I never realized how much of a pack rat I am. It seemed like an unending series of



bigger and bigger boxes kept piling into my new place. Now everything is in a new location and I'm lost in my own home. It takes me twice as long to do anything because I have to root through a dozen boxes (while delicately negotiating my way around the others) to find anything. Next time I think I'll just light a match to the whole place and start over.—**Jonathan Miller**, secretary, 1708 Plaza Court, Mountain View, CA, 94040; tel: (415) 961-2394; fax: (415) 813-1130, e-mail: <jonathan\_miller@logitech.com>

## 85 10th Reunion

Happy New Year everyone.  
Lots of news this month.  
Most important, classmate

**Robert Ungar** demolished the competition on the *Jeopardy!* quiz show on December 29, 1994, winning over \$14K in one day.

**Ernie Fasse** was spotted at the ASME International Mechanical Engineering Congress and Exposition in Chicago in November, and he was coerced into writing an update on his life: "I've been working in the Netherlands for just over a year at the University of Twente as a postdoc in the Control Laboratory of the Department of Electrical Engineering. My wife, Debora Gage, studies at Wageningen Agricultural University. We live in Zutphen, halfway between our schools. Zutphen is an old Hanze city, with medieval characteristics such as an open market, feudal economy, and public executions. (Just kidding.) We'll most likely be here until the end of next summer, until which time visitors are welcome. Our home address is: Lokenstraat 4, 7201 MP Zutphen, the Netherlands. Our home phone is: +31 5750 43707. My e-mail address is: <e.d.fasse@el.utwente.nl>."

**Curtis Tsai** writes: "I finished a PhD in EECS in September 1992. I started work at Analog Devices in Wilmington, Mass., in July 1992. Yes, I started before defending my thesis. I married Julie Tsai, '88, in September 1994 in Fremont, Calif., and lots of MIT alums were present." . . . **Richard Corkran** married Therese van Renterghem, '86 on August 21, 1994, with several MIT and Kappa Sigma alums present.

**Kerry Elkins** completed a PhD in mechanical engineering at Carnegie Mellon and has taken a job with Roadway Information Technology in Ohio. . . . **Tim McKenny** recently reported for duty at the U.S. Naval Academy in Annapolis. . . . **Diana ben-Aaron** is spending a year in Finland studying immigration there. . . . **Kyung Kim** is presently working for AC Delco Systems Division of General Motors and he is living in Indianapolis. . . . **John Stein** reports that he left Tektronix after eight years of employment to return to his specialty in semiconductor device engineering. He is now working for Fujitsu Microelectronics in Gresham, Ore., "where I am happily working on memory devices." . . . **Hisaya Sugiyama** is still in New York and going back and forth to Tokyo and Osaka for major development projects there. He writes, "I am still single, not for much longer! (keeping my fingers crossed.)"

**John Ragan** writes "I've been working at Pfizer's Central Research Division in Groton, Conn., for two and a half years now. I'm doing medicinal chemistry research directed at

developing new drugs for the treatment of osteoporosis. I've just started serving on the Alumni Corporation of Phi Beta Epsilon, which entails the pleasant obligation of driving up to Cambridge three to four times a year." . . . **Alan Williams** has had a major career change. "After nine years in the Air Force I separated on October 1, 1994, and will be traveling throughout the South Pacific and Southeast Asia for eight months. I've been rooming with **John Newton** for the last two years in Mountain View, Calif. I'll be traveling with Susan McLaughlin, my girlfriend for the past two years."

Send news to **Bill Messner**, 5927 Alder St., Pittsburgh, PA 15232; (412) 362-4180; email: <bmessner@cmu.edu>; listserver: <mit1985@mitvma.mit.edu>

## 86

Well, the class "survey" proposed a few months ago as an incentive for people to write in hasn't yet produced the desired effect, so we'll keep waiting on responses before reporting results. The mailbox this month had lots of news, so grab a cup of your favorite beverage and read on:

**Ellen Epstein**, writing from New York, reports that she married **Ray Brunsberg** in December 1994. . . . **Mark Gebert** started a new job with Cibus Pharmaceuticals, Inc., in Redwood City, Calif. . . . **Jaime Guillen** is still working for Bechtel in San Francisco in their corporate finance/project finance group. "I focus primarily on projects in Latin America and spend about 80 percent of my time developing and financing projects through the region." From time to time she meets other MIT graduates who are from Latin America or are working in the region.

**Rich Herrmann** is still enjoying his "sentence" in Bakersfield, Calif., working as an earth scientist with Chevron. He periodically visits Los Angeles to "make Bakersfield seem pleasant by comparison (if only there were oil fields in Palo Alto...)." He recently co-ordinated and wrote a winning proposal for a joint Department of Energy/Chevron research effort. This 50/50 cost share involves a reservoir characterization and field trial study of Vista Hills oilfield in southwest San Joaquin Valley at a cost of about \$11M. Rich summarizes by saying, "Your tax dollars at work!" . . . **Steven Kroft**, MD, is currently chief resident in pathology at Northwestern University in Illinois, and intends to pursue a career in academic hematopathology. He and his wife, Laura, recently celebrated their fifth wedding anniversary.

**Fred Martin** finished a PhD at the MIT Media Lab in the spring of 1994 and he currently has a post-doc position there developing educational robotics programs for middle and high school students. . . . Congratulations are in order to **Tom Kurfess**, who received a Presidential Faculty Fellowship from President Clinton at the White House. He was then promoted to associate professor at Carnegie-Mellon. In September he joined Georgia Tech's School of Mechanical Engineering as an associate professor.

**Mike Mitsumata** sends news from Japan where he is working for Cadence Design Systems. After spending five years with Teradyne, Inc., in various sales and marketing roles, he

# ClassNotes

left Teradyne and joined Cadence so he'd be able to move to Japan. He packed up from California and moved to Yokohama in October. He will be working in the marketing group of Cadence's Japanese subsidiary. . . . **Laura Bonney** received a PhD in materials science from the University of Wisconsin/Madison in May 1994 and is now living in Tallahassee, Fla. She's working at the National High Magnetic Field Lab, and has been enjoying bicycling and ultimate frisbee. . . . **Hubert Delany** recently accepted a position as program director of high-performance computing at the Connecticut-based Gartner Group, Inc. He is the first African-American analyst at Gartner Group, which went public in October 1993.

**David Anderson** writes from Santa Ana, Calif., that he married Ann Eichinger in August at Timberline Lodge, Ore. **Karl Kowalski**, Vicky Rowley, '87, Russ Howard, '81, and others were in attendance. . . . **Irwin Horowitz** recently completed a one-year postdoc at Brigham-Young University and has received an appointment as adjunct assistant professor of physics at Idaho State University. "I don't run into too many MIT alums in these parts, but I do occasionally see **Ed Ajhar** when I go observing at Kitt Peak National Observatory in Arizona."

**Jamie Orr**, finishing up as a chemistry grad student at the University of California, writes that he has gotten a job as a corrosion modeler at the Knolls Atomic Power Laboratory in Schenectady, N.Y.

Back here in Boston, the November and December weather has featured balmy temperatures as high as 50-60° F! I took off for a fabulous week-long vacation to Costa Rica over Thanksgiving, and am now working with the MIT Club of Boston on a membership survey to see how we can more effectively meet the needs of the MIT alums in the area. If anyone is interested in the results, let me know and I'll be glad to fill you in.—**Bill Hobbib**, 5 Cappy Cir., West Newton, MA 02165; <hobbib@cognex.com>

## 87

Hi...I'm busy, though I hope that by the time this gets printed, life will have calmed down somewhat for me.

Teaching four courses while trying to complete my dissertation is a big chunk of work! To keep the progress up, I've resorted to schemes like writing sections on a PowerBook while proctoring exams, and pushing deadlines (like for this column, which is now four days late and counting...). Some of these time management skills (as well as the PowerBook) would have come in handy while I was an undergraduate at the 'Tute!

**Kim Chasteen** writes: "Doug and I moved into our new house in October, several months late. We learned that continuous pressure must be applied to builders in order to get them to build. We are also busy getting Doug through the PhD program he started last fall."

After spending four months at Bose on the "dreaded" headset project, **Andrew Ferencz**



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escaped to a small company which subsequently lost all of its employees except for him and the owner. Andrew is now with a brand-new start-up called Advanced Power Solutions—so new that they have only just signed a lease and begun hiring! . . . **Steve Berczuk** and his wife, Lena, have just closed on their "new" house: an 1890's Victorian in rather good condition, save for the "Brady Bunch" decor—lots of avocado appliances, brown shag rugs, and dark paneling. Since it is only a block away from their old house, they are able to shuttle back and forth while doing repairs, and hope to have had everything completed by January.

**Kevin Hurst** has no new jobs or babies to report, but is glad to report that he is only a year away from completing a PhD at Georgia Tech. He spent the month of May at Politecnico di Torini in Italy, doing research in their Electronic Machines Group. In June, Kevin and his wife traveled to Taipei, Taiwan, where he presented a paper at the IEEE Power Electronics Specialists Conference. He also presented a paper at an IEEE conference in Denver last October.

**Canaan Matthew Linder** was born on August 7th 1994 at 1:01 p.m. in San Mateo, Calif., weighing in at 6 lb. 11 oz. Mom Jacqueline (Fischer) Linder, SM '90, and dad **Ben Linder** are doing fine and trying to catch up on lost sleep. Both are now back at work: Jacqueline at NeXT, and Ben at Oracle.

**Lauren (Mahorter) Snellgrove** writes: "My husband, Glenn, and I had a baby boy, James Daniel Snellgrove, born on my birthday, June 9th 1994, at 4:05 p.m.. He weighed 7 lb. 1.5 oz., and was 19.25 inches long. We're hoping for a slot in the MIT Class of 2012! His proud granddad, Bob Mahorter, is a member of the MIT Class of 1957. We're still living in Huntsville, Ala., and I am working at the Marshall Space Flight Center. James was the youngest spectator when the Space Shuttle visited Huntsville on October 8th."

**Joseph Zahavi** is still working at Hughes Aircraft in Southern California. He took the summer off and spent seven weeks in Jerusalem, studying Jewish thought and philosophy at a Yeshiva (school) there. He and Mari Cartagenova, a Brandeis student whom he met last year in California, were busy planning their wedding, which was to be held in Los Angeles on January 1, 1995.

**Renee J. Miller** is making her career in the Big Ten: She finished a PhD in computer science at the University of Wisconsin, and has just started her position as an assistant professor at Ohio State University. She reports that she is enjoying Columbus, and the wonderful self-deprecating humor of Ohio, and asks rhetorically: "Where else would people name themselves after a useless nut?"

**Joe Morgan** marked his 30th birthday by having his gallbladder removed. Though an uncomfortable process, the surgery has alleviated some tremendous, spontaneous pain that had been plaguing him since last June. Since recently leaving his position as a Naval nuclear submarine officer, Joe has started a new career—as Mr. Pinball! An old friend of his has asked him to run his amusement vending company called Sunshine Enterprises. The company is based in Joe's hometown of Birmingham, Ala., and has arcade- and bar-type vending machines located throughout Alabama and Florida. Joe is very excited about the

prospects for the company (which is growing at a rate of 30 percent per year), and about the change in life style.

As usual, **Greer Tan Swiston** has news about a number of classmates. **Eugene Pan** has taken a job at Advanced Micro Devices, and is now settled in Austin, Tex. **Taoi Doan** just accepted a new position at a company located in Santa Cruz, Calif. **Jay Cohan**, who has taken time off to travel, returned to the States briefly after his biking tour of Europe, and ran in the New York Marathon, along with classmate **Dave Napoli**. He then took off with his girlfriend, Cindy, to spend the winter months somewhere in the Caribbean and Mexico. Since he is roaming, he requests that anyone wishing to get in touch with him contact his mother in Florida. As for Greer and her husband **Rob**: They just sold their house after building a new one about two miles away in West Newton, and moved in about a week before Christmas.

Class President **Stephanie Levin Koenig** and her husband, Class Agent **Jim**, checked in with an update on the New York Crew: Besides cheering on the aforementioned Dave and Jay in the New York Marathon, Stephanie, her sister Suzanne, Jim, and **Lowell Kim** traveled to Spain this past November. They also mention that **Dan Kennedy** has become engaged, and wish him and his fiancée, Ruth, well. Jim is still working as a high-technology lawyer with Weil, Gotshal and Manges. Stephanie works for the city of New York, and is responsible for oversight of the Department of Social Services (Child Welfare, Medicaid, Day Care and Public Assistance) at the NYC Office of Management and Budget.

After three years at Fort Stewart, **Andrew Sterbenz** is finally finished with the 24th Infantry Division. His next assignment, which started in November, is with the 5th U.S. Army at Fort Sam Houston, in San Antonio, Tex. Andrew is working with a team that evaluates and advises units in the National Guard and Reserves throughout the South-Central United States. Though his wife, Toni, has left the Army, she has enjoyed the move to San Antonio.

**Stacy Katchman** is still working in the Department of Dermatology at Jefferson Medical College in Philadelphia, Pa. She spends part of her time doing clinical work in dermatology, and the rest doing research in the field of gene regulation of the extra cellular matrix. She expects to complete her training in about two years. Stacy's husband, Phil, is a resident in orthopedic surgery at the same hospital, and will complete his training in about a year.

**Todd Abler** just finished flight school (for the second time), and received his pilot wings on December 15th. He is planning to marry **Vannessa Lenoir** on January 21st, in Meridian, Miss. They met while Todd was attending flight school there. After a honeymoon trip to Jamaica, Todd and Vannessa will, along with her little girl, Jessica, move to Whidbey Island, Wash., where Todd will fly the EA-6B Prowler.

I picked up a copy of **Simson Garfinkel's** book, *The UNIX Hater's Handbook*, for a friend of mine, and got a chance to flip through it before wrapping it up. It really is quite funny, and contains lots of useful (and some obscure) information about the UNIX system. Simson's newest book, called *PGP: Pretty Good Privacy*, is about state-of-the-art



software used to help protect files and electronic mail on the Internet. It is both a technical user's guide, as well as a behind-the-scenes look at the development of PGP and the politics which surround the issue of cryptography in general. The press release that I was sent describes the book as both "highly readable" and "fascinating."

**Andy Gerber** and **Todd Ogawa** continue their life in Denver. Todd finished his medical residency at the University of Colorado in June, and started full time work with Premier Medical Group as an internist. Andy continues consulting work for US WEST where he is now managing development on a legacy system data access project. Andy and Todd were both happy to return for the wedding of Simson Garfinkel in October. Andy held the ring for Simson, and also one of the poles of the traditional tent (Chupa) over the couple during the ceremony. It was a beautiful service at the Harvard Hillel, and the weather cooperated with a dry sunny Boston fall day. The wedding reception (held at the swanky and appropriate Computer Museum) was attended by fellow alumni Ben Stanger, '88, and Stever Robbins, '86, as well as classmates Jim and Stephanie Levin Koenig.

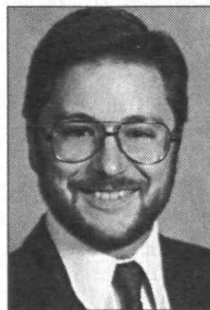
Briefly: **Dave Jesurum** married Pamela Tamis on August 28, 1994 (details, anybody?). . . . **Thomas Swengros** is married, and has two children: TJ, born on September 16, 1991, and Christine, who was just born this past May 18th. Tom is employed as a computer consultant/programmer. . . . **Ron Becker** is reported to be a "qualified doctor" and is enjoying his new job in pediatrics. . . . **Chuck Davis** has recently left Kimberly-Clark, and is now working for Goldman, Sachs in their New York City Office. Chuck is with the SWAPS Operations group, where he will try to make sure that those "pesky derivatives" remain under control.—Send all news to: **Jack Leifer**, secretary, 2908 Roses Run, Aiken, SC 29803; Home: (803) 642-3900; Work: (803) 648-6851; fax: (803) 642-2700; email: <leifer@scarolina.edu> or <MIT1987@mitvma.mit.edu>

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**Lon Sunshine** is currently living on Beacon Hill and is working on a PhD in the Advanced Television Research Group. Lon is (still) a first lieutenant in the Medical Service Corps in the Army Reserve. Lon was held hostage at my house (with no dinner) until he provided information on some of his ADP brothers. In a recent trip to Washington, D.C., Lon visited **Frank Chirichosta**, who is an Army pathologist at Walter Reed Medical Center. Frank received a medical degree from George Washington University in 1992 and lives in Arlington, Va., with his wife, Tracy. . . . **Pedro Almeida** came to Boston Labor Day weekend. Pedro is also in the Army and is stationed at the National Training Center at Fort Irwin where he is an evaluator. . . . **Pierre Chao** works at Smith Barney and lives in midtown Manhattan.

**Susan Lee** received a PhD in mathematics from Cornell University in August 1994. She is now a postdoc at UCSD, and next August, she'll begin a tenure-track professorship at New Mexico State University in Las Cruces. . . . **Hanson Cheah** lives in Penang, Malaysia, and

is working for Solecron Corp. . . . **Mark Light** will be starting a postdoc in Tübingen, Germany, after he finishes a PhD at the University of Rochester. . . . **Jill Gauding Light** will join Mark in June after graduating from Cornell Law School. . . . **Michael Skeldon** has



**Michael Skeldon**

been named VP of KRI Management, Inc., of Lexington. Michael is also doing graduate work in civil engineering at MIT. . . . **Michael Munoz** recently moved to New York from San Jose after quitting IBM. Mike now works for that mecca of software engineering known as Pepsi-Cola.

**Tom Kronenberg** was married in June to Janelle Martini, an old high school friend (though not an old flame). They bought a house in Cincinnati. Tom is adjusting to a new job as systems engineer manager at Unosource Controls Inc.

**Peter Schmidt** writes to say that he and his wife, **Hollie** (née Mahaney, '87) are expecting their first child on St. Patrick's Day. Donations of baby stuff are being accepted with both hands. He also notes that their company, **Midnight Networks**, is up to 10 employees and looks to take in nearly \$1 million in 1994. This is keeping them plenty busy, and is keeping several other alums out of trouble, too (well, mostly): **Art Mellor**, '85, **Topher Heigham**, '87, **Peter Desnoyers**, **John Reardon**, '90, **Alan Steele**, '91, and, with occasional cameo appearances in a sub-contracting role, **VI-Aer Matt Birkholz**, '85, SM '93.

**Peter L. Standley** and his wife, **Mindy**, have a new addition to the family. **Laura Beth** arrived in August and is now filling up all of their time and then some. Peter is still working at Draper right across the street from the "Tute. He has been involved in eliminating ODCs from precision system cleaning cycles.

As always, **David Saslav** and wife **Melissa** are busy with music. David has even started several singing groups, one of which you could have heard singing at the Oakland A's National Anthem contest (David's television conducting debut—they were shown on half a dozen local TV news broadcasts that night) or at the Menlo Park Farmer's Market. His newly founded small group "The Primary Keys" will be giving a private recital (its concert debut) in Berkeley next month. The California Bach Society (the group that brought **Melissa** and **David** together) has a new CD out, featuring David's first digital solo (all of seven notes).

**Steve Beaudoin** plans to finish a PhD at N.C. State in the spring or early summer, and hopes to find a faculty position. Steve works on mass transfer processes aimed at environmental issues, with a goal of preventing pollution before it reaches the great outdoors.

**Elaine Cohen-Hubal** is also at N. C. State, working on a PhD. At the AICHE meeting in San Francisco, Steve saw a bunch of MIT folks at the MIT Hospitality suite. He also saw Dr. **Mohr** and Dr. **Hatton**, and thoroughly enjoyed talking to both of them. . . . **Norm Chen** is an MD now. He got his degree from the University of Virginia and is doing his residency in radiology in San Diego.

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**Ernest Prabhakar** writes that he has just started to write his thesis and hopes to graduate by June. Ernest plans to either stay in California or move back to the Midwest. He trusts that God will open (and close!) the right doors. He writes that it is hard to believe that he is leaving Caltech after nearly seven years and feels like Jacob in Genesis, except without the wife. He just finished playing a soldier in Shakespeare's *Julius Caesar*, which gave new meaning to the phrase "I die daily" (1 Corinthians 15:31). Ernest is trying to give away his responsibilities with the Graduate Student Council, where he is considered the official Dinosaur. Ernest has become involved with the "Twenty-Something Fellowship" at his church, a group which is committed to asking the hard questions about what it means to apply the unchanging gospel to our generation.

**Lily Huang** graduated from Wharton in May '93 and worked for a year in New York City. Lily is now working for the *LA Times*. **Lynn Hazan** also graduated from Wharton and is now working for BMG in NYC.

**Alfred Tadros** writes that he has been working on satellite dynamics and controls analysis at Space Systems of Loral for the past four and one half years. He is now in a technical marketing position for Loral's GPS TENSOR product, which will provide position and attitude information for spacecraft. During his free time, he enjoys windsurfing, mountain biking, and skiing—just enjoying California.

**Ricardo Zemella** writes that he is part of a founding team of Bancomer Securities in New York. Before this, he worked at JPL from 1990 to 1992, and then went to Stanford and received a master's in industrial engineering and engineering management. He then worked at Smith Barney Shearson in New York.

**Mark Tervalon** has recently been promoted to manufacturing manager over the front end of a printed circuit board plant for AT&T. He writes that this encompasses all interlayer for high layer count circuit packs, and is a lot of fun.

The Class of '88 e-mail list has now grown to 250 classmates! If you have an e-mail address and have not received any desperate pleas from me for news please send me your Internet address. I also love getting real mail, so keep those letters coming.—**Catherine Suriano Singer**, secretary, 131 Main Street Andover, MA 01810; <singer@mit.edu>

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Greetings, I've received the biggest paper news packet this month, which actually isn't saying much, but it does add substantially to the news I've received over e-mail.

This month's list of people to please send news is: **Joann Chee**, **Jarrod Fraser**, **Jeffrey Hornstein**, **Elizabeth Ling**, **Alan Nash**, and **Suzanne Wurster**. What are y'all up to? If anyone knows about any of these people or anyone else, please write in.

"As always, it was a pleasure receiving the Class Notes so far in advance," writes **Barry Margulies**, who is on the Class of '89 e-mail list. "I just renewed *Tech Review* with a bigger donation than I could really afford, then realized the only reason I was getting it was for Class Notes, which I get from you. I guess it's ok, though, because MIT will (hopefully) use the money wisely." [Thanks to everyone who

continues to contribute and support our class and MIT through dues, donations, and news!]

"With a modicum of luck, I'll be outta here this academic year," Barry continues. "I'm pretty close to finishing what my thesis committee wants, so we'll see."

**Kenneth Goodson** has spent a year and a half working at the Research Facility of Daimler-Benz in Ulm, Germany, and is now an assistant professor of mechanical engineering at Stanford. Ken married Laura Dahl on August 13, 1994, in Bozeman, Mont. Laura, a pianist, received a BS and MS from the University of Michigan and New England Conservatory, respectively. Ken and Laura are now living in Atherton, Calif. . . . **Tony Fiorino** recently married Deborah Goldberg (Barnard '92), and now Tony is putting the finishing touches on his thesis (cellular mechanisms in hepatocyte differentiation). Tony started his third year clerkships, the last phase of the MD-PhD program at the Albert Einstein College of Medicine, last October. . . . **Chris Macada** is still a full-time student at CMU, even though he has been working on his dissertation in Seattle. Chris left for a San Francisco and Honolulu vacation for the holidays, and promised to write upon his return.

**Leslie Liu** graduated from TPP last May and has been in Japan since June, working at the Central Research Institute of the Electric Power Industry. "I am here for one year doing research on environmental policy and global warming," Leslie writes. "My husband, Ling Yi Liu, '85, has been here for over a year working for Sony Corp. and we are enjoying life together in Tokyo. Although we haven't had many chances to travel around in Japan, we have done several excursions close to Tokyo. During the summer we climbed Mt. Fuji and also watched shooting stars and we have gone hiking in the hills outside of Tokyo."

"As a big surprise, we discovered that another MIT graduate, Mike Cronk, '85, and his wife were living in our neighborhood. We met them because one Sunday Ling Yi noticed a Caucasian riding in our train who then went to the same church that we did (it was Mike). Although Ling Yi and Mike didn't know each other at MIT, we are now very glad to have friends nearby," Leslie continues.

Last November, Leslie took a trip back to Boston to attend an MIT forum on global change. "It was great to be back and I felt like I hadn't really left. After that Ling Yi and I vacationed in Las Vegas and San Francisco, visiting family in both places. A highlight was a trip to Yosemite. It was absolutely grand and beautiful, and a total contrast to the congested, concrete structures of Tokyo! We'll be in Japan for the holidays. The end of the year is quite a festive time for Japanese, although Christmas is purely a commercial opportunity for merchants. (The Japanese have to work on Christmas day.) But I hope everyone, wherever they are, will have a Merry Christmas!"

After attending the Combined Logistics Officer Advanced Course at Fort Lee, Va., following an overseas tour in South Korea, First Lieutenant **Sherman Huang** reported to his next duty station in Fort Polk, La., in December.

**Eric Tang** is now at Sigma Designs, a company that makes MPEG products for multimedia PCs. "I'll be designing chips and boards for them!" Eric writes, expecting to be quite busy.

**Elizabeth (Clapp) Goodrich** and her husband, Paul, had their first baby, "a beautiful daughter named Eileen Marie, on June 12." Elizabeth writes that "being a mother is great and I am sure, of course, that she is the prettiest and smartest baby ever! After 12 weeks away from work and being a family, it was rough to go back to work." Both Elizabeth and Paul are back to work at Genentech in South San Francisco, and Eileen is enjoying herself just down the road at Genentech's "Second Generation" daycare facility.

"True to my word, I'm sitting down to send you some news," writes **Matt Rita**. "As you may recall, I informed you in my last transmission that my family and I were preparing to relocate to Colorado. We've since made the westward move and settled in Denver, Colo. Our plan is to live here in Denver for one year, during which time we'll look for a home to buy—perhaps in one of the mountain towns west of the city."

The reason that Matt and his wife, Liz, decided to head west with their 7-month-old daughter, Katie, was summed up in three words: "quality of life." Matt writes that "While my native state of Massachusetts will always hold a special place in my heart, the fact of the matter is that the pace (and cost) of living here in Liz's native state make it a better place to work and raise a family. (And the skiing ain't bad, either!) Lest I be accused of treason, allow me to assure you that my first allegiance will always be to the Red Sox, no matter how well the Rockies may perform." Matt has joined Holme Roberts & Owen, one of the oldest and largest law firms in the Rocky Mountain region. Liz, who is also an attorney, is contemplating a number of part-time opportunities, including some interesting pro bono undertakings. "Our true 'boss,' of course, is little Katie."

Matt continues that they've "heard from a number of my friends from Theta Delta Chi. Just before leaving the Boston area, we got together with **Dave Stracher**, **Mike Petro** and his wife, **Sue**; **Dave Blundin**, '88; **Tim Hawkey**, '88; **John Lunny**, '87; and **Loggin Kapitan**, '85. We also ran into **Boris Zemelman** and his wife, **Cheryl**, at a September wedding on Cape Cod."

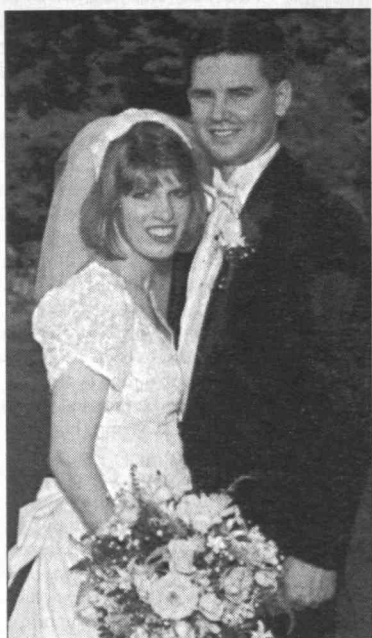
**Ron Koo** is taking a series of processing courses at Stanford right now which fill in extremely relevant background information on the semiconductor industry. "One Stanford course per quarter is enough of a drain on my free time," Ron writes, as he has been extremely busy working at Maxim these days.

**Illy King** is also still working for Maxim, where she has been working at since graduating in '89. **Lisa Liou**, **Judy Chen**, **Ting Kao**, **Tammy Chu**, **George Wang**, **Illy**, and other classmates flew to Houston at the beginning of September for the wedding of **Wendy Wang** and **Alex Chung**.

**Anthony Lombardo** visited **Peter Neirinx** twice this past year. The first, at the beginning of August, was just hours before Peter's wife Kate, went into labor with their first son, Gage. "In fact, they credit me with inducing labor," Anthony writes. "By wearing a Star Trek outfit when we all went out for ice cream, I caused Kate such a fit of giggles that it brought her to the maternity ward the following day. At 4 months old, Gage is both beautiful and precocious. He blinks in prime numbers per minute, coos in harmonic fre-



# ClassNotes



**John Mruz, '90, and  
Christine Oswald**

consulting with ABT Associates. She was married on January 1, 1993, and now lives in Cambridge, Mass.

**Helen Delichatsios** graduated from Cornell Medical School in May 1994, and is now doing her residency in internal medicine at The New York Hospital in Manhattan. Her husband, **Tassos Pittas**, '91, will graduate from Cornell Medical School in May 1995, and is currently applying to programs in internal medicine. . . . **Carlos Cabre** writes that in 1992, he got his PE license and founded **Carlos I. Cabre & Associates**, an engineering consulting firm. Since the fall of 1993, **Carlos Rabell**, '93, has been working with Carlos. In the past year, they have designed several residences and commercial facilities. They are looking forward to more new and exciting opportunities!

**Jay Damask** is still in graduate school at MIT. He's working on photonic integrated circuits in Course VI (remember? that's EECS). Jay hopes to graduate sometime between June and September 1995. In the past year, Jay has also managed to find time to travel. He saw **Howard Weingram** in San Francisco, just missed **Jose Villeta** in Munich, Germany, by 100 miles, and traveled to Hiroshima, Kyoto, and Tokyo with his girlfriend, **Lauren Doyle**. This year, Jay plans to travel to San Diego and back to Japan, where his girlfriend had lived for two years.

**Jose Villeta** started an entertainment software company in Los Angeles called **Black Ops Entertainment, Inc.**, with some other MIT graduates. They are looking to hire people interested in working in a high-paced, small-business environment. In particular, they need C programmers and MIPS assembler programmers. Undergraduates are also welcome to apply and you don't have to move to LA to work for them! If you're interested or know of

anyone who is, drop a note to Jose at 3036 Gertrude St., Rosamond, CA 93560.

**John Mruz** married his longtime girlfriend, **Christine Oswald**, on August 13, 1994 [See photo at left.] The wedding was held in East Northport, N.Y., where they both grew up. Numerous MIT alums were there, including best man **John Ziegler**, **Mike Valdez**, **Andy Nisbet**, **Curt Wu**, **Steve Emeott**, '89, **Darius Sankey**, '88, **Rick Kim**, '88, **Sandy Serkes**, and Sandy's husband, **Aaron Goodisman**. It's interesting to note that John and Sandy seem to be following each other. Not only did John and Sandy go to junior high, high school and MIT together, they are now both in their first year at the Harvard Business School. John mentions that **Curt Wu**, **John Ziegler**, and **Mike Valdez**, all Phi Delt alums, are living in the Boston area. They are all doing well, have given up coffee, and are ready to "pursue a life of religious fulfillment." John and Christine now live in Cambridge, just south of Harvard Square. Christine is in her final year at the Harvard Law School. They plan to move to northern New Jersey after they graduate next year.

**Veronique Bartman**, '89, writes that she and her husband, **Thomas Bartman**, '89, attended the wedding of our classmate **David Plass** and **Susan Rodis**. The wedding was held at the Temple Beth-El in Great Neck, N.Y., on October 9, 1994. David and Susan met through their temple singles club. [See photo below.] After the wedding, David and Susan honeymooned in Aruba for one week and then took a Royal Caribbean cruise for five days to the Bahamas. David is director of

quencies, and spits up the Fibonacci sequence. Of course, he (Gage, not Pete) dirties 3.14159 diapers a day."

Well, that's it again for this month. Please send in news! Photos for next year's calendar (we'll even accept GIF or any electronic file format for photos) would be great as well!—**Henry Houh**, secretary, 4 Ames St., Cambridge, MA 02142; phone: (617) 225-6680; fax: (617) 253-2673; e-mail: <hhh@mit.edu> or <henry\_houh@mit.edu>—And remember to check out the first World Wide Web URL to be published in *Tech Review*!: <<http://www.tns.lcs.mit.edu/mit89/>>.

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## 5th Reunion

I am pleased to announce that the MIT Alumni/ae Association has selected **Stephen McNamara**, a senior from Fort Salonga, N.Y., as the first recipient of the Class of 1990 Scholarship. Stephen is a double major in economics and mathematics with a perfect 5.0 GPA. Last year and during the summer, he did a UROP entitled "Economic Analysis of National and International Investment." He has also worked as a research assistant at Brookhaven National Labs in New York. Stephen enjoys basketball, tennis, and ice skating. He plans to pursue a PhD in economics and a career in teaching and research. The MIT Alumni/ae Association extends a special thank you to everyone who has contributed towards this fund.

News for this month: **Craig Hicks** is a second-year doctoral student at the Tokyo Institute of Technology. He's busy studying pattern recognition, neural networks, and theories of learning. . . . **Julia (Drewry) Harrod** married **W. Owen Harrod** on October 8, 1994. . . . **Bhavya Lal** is working in policy



**The wedding of David Plass, '90, and Susan Rodis included MIT grads (from left to right in the picture below) Dave Tabak, '90, Christine Tsien, '91, Scott Fullam, '90, Tom Bartman, '89, Adam Kao, '89, Veronique Bartman, '89, and David Martin, '90. (The fellow at far right is Rob Yentel, a Columbia '92 graduate.)**



software development for Schick Technologies in Long Island City. His group works on digital X-rays for dentists. Coincidentally, his wife is an orthodontist.

Dave Tabak is working on a PhD in economics at Harvard. David Martin is working on a PhD in Course VI at MIT—that's almost a decade he's been at MIT! Scott Fullam is working for Microsoft in the Silicon Valley area, but we're not quite sure exactly what he does for them.

Last bit of news for this issue: Feroze Deen recently made a trip to visit Vijay Vaitheeswaran in Mexico City, where Vijay works for *The Economist*. I was sent a picture that shows how much fun they had down there. Apparently, one night, Vijay was convinced that he wanted to try and "ride the bull." The picture above documents the event ... notice that there is a missing horn on the bull ... Vijay, what really happened?

Does everyone remember that it's almost our 5th Year Class Reunion? I hope you are all making plans to get out to Boston in June! Give me a call if you have questions—or if you would like to help out! Also, as always, keep sending those notes in for the column. I haven't heard from everyone yet!

Send news to Ning Peng, secretary, 732 Bounty Dr., #3215, Foster City, CA 94404; (415) 578-0704

**91** Greetings! Barry Hemmerdinger lives in Falls Church, Va., and works for ERA, a division of E-Systems, in Tysons Corner. He expects to be finished with his EE master's degree in May, and writes, "Can't wait to be done with classes—but then there's business school ..."

Anne C. Jones is in her fourth year of medical school at the University of Massachusetts. In November 1992, she married Larry Jones, a 1988 SM in EE from MIT. ... Neil Okamoto lives in Los Angeles and works for Walt Disney Feature Animation. His current project is to work on the next major release, called "Pocahontas." ... Giovanna Fazzari works at Interleaf, a Massachusetts company. She was promoted to senior consultant last fall, and lives with Chris Casey, '87.

Bennett Brown is in his third year of teaching physics in an inner-city high school. He writes, "I create a lot of my own curriculum, guiding students to make and write about cheap, simple



Vijay Vaitheeswaran, '90, vs. the techno-taurus

versions of technological items: stereo speakers, computers, musical instruments, cameras, etc. I am currently working on establishing an Internet computer lab at the school." Last May, Bennett received national attention for his outstanding effort and achievement as a teacher when he was featured on *Day One*, an ABC news magazine.

Please send your latest news to: Andrew Strehle, secretary, 59 Commonwealth Ave., Apt. 4R, Boston, MA 02116, (617) 450-0637. Send e-mail to Renee Miller: <miller-rl@post7.laafb.af.mil>

**92** Hey gang! Received word that Les Kalman went white-water rafting on the Salmon River with Meredith McKenzie, '93, and Wendy Sander, '93. Les recently relocated to Los Angeles where he's working as a mechanical engineer.

Tzu-Jun Yen writes that she is currently working at Gillette, designing new products,

and really enjoying her work. She also started taking French classes at the Harvard Extension School, as she hopes to go to Paris one of these days. ... Laurel Mahoney is a second year law student in Boston and the co-producer of "French Kisses" on WMBR, MIT's radio station at 88.1 FM on the dial. Last July 4th, Laurel spent time in New York City with Katherine Allran and Albert Woo, '90. ... Judy Chin is attending Columbia University Business School and expects to graduate in May 1996. She is also engaged to be married in May 1996 to Tai Wong (Harvard '92).

David Shane Cherry is a PhD student in geography and environmental engineering at Johns Hopkins University. He and his wife, Kristin, happily married for almost three years, enjoy taking day trips in the mid-Atlantic region of the country. ... Patrick Malone writes about

his life after MIT, "I became a firefighter at a city fire department in South Carolina after graduation. Now I am in California, programming educational software for children. Just finished *Reader Rabbit 1* CD-ROM." ... Elena D'Agostino and Rick Pryll were married almost a year ago. Elena is finishing her second year at Fordham Law School.

Keep writing to me.—Leslie Barnett, secretary, 88 Indian Hill Rd., Bedford, NY 10506

**93**

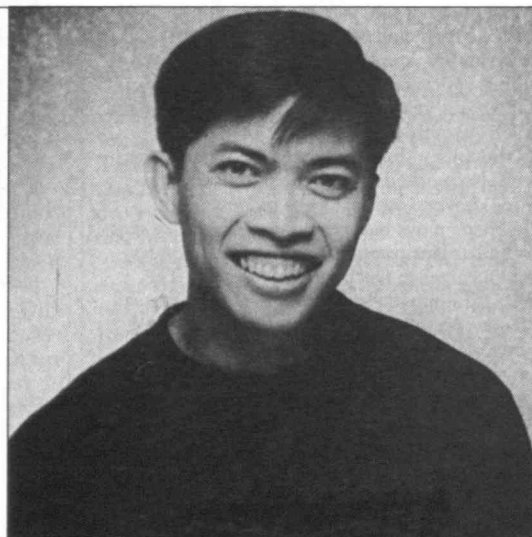
Please send news for this column to:

Mari Madsen, secretary  
12-16 Ellery St., #405  
Cambridge, MA 02138

**94**

Please send news for this column to: Walt Babiec, president, c/o Aerospace Corp., Box 92957, Mail Stop M4/922, Los Angeles, CA 90009

*In the spring of 1992, Jeff Ranara (aka Jeff Jimenez, '91) won rave reviews for his outstanding performance as Song Liling in M. Butterfly at the Palace Theatre in Manchester, N.H. (see November/December 1992, p. MIT 33). Now he's in an intensive one-year acting program operated by Carnegie Mellon University and the Moscow Art Theater. From late January to early June 1995, he reports, "we're taking The Grapes of Wrath to Moscow, for which I've learned to play the fiddle. I'm also presenting my original solo work, "On the Yellow Brick Road" in the Studio Theater in Pittsburgh."*





# CourseNews

## CIVIL AND ENVIRONMENTAL ENGINEERING

During the past year, U.S. Army Major Gregg F. Martin, SM '88 (I, TPP), PhD '92, was operations officer and then executive officer of the 864th Engineer Combat Battalion at Fort Lewis, Wash. His unit has been involved in planning and executing civic action and humanitarian construction operations in Paraguay, Honduras, and Thailand. Last summer, his battalion fought the forest fires in Idaho. . . . From West Vancouver, B.C., Salvador Miranda-Barreda, SM '82, writes: "I started a new business to encourage North American companies to do business in Mexico. We help bridge cultural gaps and help in contacting the right business partners." . . . Robert Karasek, SM '74, PhD '69, has been awarded tenure at the University of Massachusetts/Lowell, where he is co-director of the Lorin E. Kerr Ergonomics Institute for Occupational Injury Prevention and professor of work environment at the College of Engineering. He is a specialist in the psycho-social aspects of work redesign processes and coauthor of *Healthy Work: Stress, Productivity and the Reconstruction of Working Life*. Most recently, he was guest professor of industrial psychology at Aarhus University in Denmark and guest researcher at Halmsted University in Sweden. . . . David A. Hamilton, SM '77, who is chief of the water management section in the Michigan department of natural resources, sends word: "I am married to Debbie and we have two daughters, Anna Marie (age 7) and Christie (age 2)." . . . David A. Peters, SM '77, has been promoted to VP of URS Consultants, Inc. He works in the Boston office, and is project manager for the I-90 Bird Island Flats Tunnel, a \$300 million section of Boston's Central Artery/Tunnel Project.

*Alumni/ae may send information for Course News to <mitalum@mitvmc.mit.edu>.*

## MECHANICAL ENGINEERING

Having completed his tour as chairman of the 2,000-member Chicago section of the SAE,

Charles R. Cornell, SM '69, reports: "I continue as VP for systems engineering at DAI Controls where we develop and produce electronic engine control systems for gasoline and diesel engines converted to burn alternative fuels."

. . . Richard K. Miller, SM '72, writes: "I was appointed dean of engineering at the University of Iowa in 1992. I now live in Iowa City with my wife, Beth, and daughters, Katherine and Julia." . . . Jeffrey R. Bailey, SM '81 (TPP), ScD '88, is working with Exxon in Houston and has three children, Betsy, Lucy and George. . . . Boris Rubinsky, PhD '81, has been named a fellow of the American Society of Mechanical Engineers (ASME), a title conferred upon a member with at least 10 years active engineering practice who has made significant contributions to the field. "He is an international leader in the application of engineering principles to the solution of problems in low-temperature biological processes and his innovative work in the field of cryogenics has earned him several patents and awards. He has been published widely and chaired various professional committees," notes the ASME news release. He is a professor at the University of California/Berkeley and lives in Albany, Calif. . . . Donald P. Travis, PhD '72, has been named president, COO, and member of the board of directors of Koppers Industries, Inc. in Pittsburgh, Pa. He comments on his new position: "The company, an industrial manufacturer which supplies blast-furnace and foundry coke, treated-wood and coal-tar products, is engaged in a number of vital businesses which have made great strides in serving customers with a focus on total quality." . . .

Mark J. Underwood, SM '83 (OCE'83, XIII), retired from active duty in the U.S. Navy last September. He has joined AMI International, a naval analysis and consulting firm, as VP and senior analyst. A professional engineer in the states of Virginia and Washington, he is also active in the American Society of Naval Engineers (ASNE) and the Society of Naval Architects and Marine Engineers (SNAME). . . . Stephan Billian, SM '88 (II, XIII), completed a five-month internship with Matson Navigation Co., a shipping company operating container ships between the West Coast and Hawaii. He is currently assigned to the Coast Guard Marine Safety Center, Hull

Division/MODU Branch in Washington, D.C.

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## MATERIALS SCIENCE AND ENGINEERING

From Port Deposit, Md., Joseph M. Wells, ScD '70, writes: "I was appointed a member of the Army Acquisition Corps and now serve as technical team leader of the inorganic composite materials research group at the Aberdeen Proving Ground research lab. I have also been appointed adjunct professor in the Department of Mechanical Engineering at the University of Maryland, Baltimore County Campus, and a fellow in the Department of Materials Science and Engineering at the Johns Hopkins University."

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## ARCHITECTURE

John G. Rauma, MAR '52, who closed his practice as president of Griswold, Rauma, Egge and Olson in 1989, continues as adjunct professor in the Department of Architecture at the University of Minnesota and advisor to the capitol area architectural and planning board for the State of Minnesota. He writes: "I am currently working on documentation of urban images related to the Mississippi River in Minneapolis and St. Paul and am funded in part by the L.B. Anderson Fellowship Program Award from MIT." . . . Martha E. Ondras, MAR '74, sends a postcard featuring a 45-station undergraduate teaching facility at Tufts University's Pearson Chemistry Laboratory designed by Ondras Associates. "The facility is designed to offer computer-aided experimentation and flexibility in teacher-to-student ratio," she notes. . . . Martha Lampkin Welborne, MAA '81, MCP '81 (XI), has been promoted to director of planning for the Los Angeles office of Skidmore, Owings & Merrill. Most recently, she led the urban design

### DEGREE CODES

AE Aeronautical Engineer  
BE Building Engineer  
CE Civil Engineer  
CHE Chemical Engineer  
CSE Computer Science Engineer  
DPH Doctor of Public Health  
EAA Aeronautical & Astronautical Engineer  
EE Electrical Engineer  
EGD Doctor of Engineering

ENE Environmental Engineer  
MAA Master in Architecture Advanced Studies  
MAE Materials Engineer  
MAR Master in Architecture  
MCP Master in City Planning  
ME Mechanical Engineer  
MET Meteorologist  
MIE Mineral Engineer  
MME Marine Mechanical Engineer  
MNG Master in Engineering

MPH Master in Public Health  
MTE Metallurgical Engineer  
NA Naval Architect  
NE Naval Engineer  
NUE Nuclear Engineer  
OCE Ocean Engineer  
PhD Doctor in Philosophy  
ScD Doctor of Science  
SE Sanitary Engineer  
SM Master of Science



# GAZETTE

## MIT ALUMNI JOB LISTINGS

- A bi-weekly bulletin giving employers the opportunity to reach experienced MIT graduates, and MIT graduates the opportunity to scan the market.
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**Martha Welborne**

Ariz. . . Robert A. Brown, SM '93, notes on his Alumni/ae Fund return card that he is now a "gargantuan land developer."

*Alumni/ae may send information for Course News to <mitalum@mitvmc.mit.edu>.*

## V CHEMISTRY

Mark J. Engler, PhD '69, head of clinical physics at Tufts-New England Medical Center, was recently appointed senior physicist . . . Robert B. Frye, PhD '76, is manager of technology for the Selkirk, N.Y., site of GE Plastics . . . We've received word from Manila that Ramon R. Miranda, PhD '90, is assistant professor at the Institute of Chemistry of the University of the Philippines.

The Association of Alumni and Alumnae has been notified that Arthur J. Haas Jr., PhD '35, died in February 1994. No further information was provided.

*Alumni/ae may send information for Course News to <mitalum@mitvmc.mit.edu>.*

## VI ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

From Zephyrhills, Fla., Wesley W. Pendleton, Sr., SM '40 writes: "Marion and I had a very enjoyable summer in Muskegon, Mich. The peak of the six months (May to October) was our 55th wedding anniversary celebration. We went to the Canadian "Soo" and took the diesel train 100 miles north to the Agawa Canyon. Later, we joined a northern group of our Florida friends for a picnic in Harrison, Mich. Finally, our travels took us to the Binghamton area of New York state. In October, besides our visiting family members, we had a never-to-be-forgotten view of the southern tier hills in their brightest colors. We also enjoyed bridge games all summer long. Quite a summer for two octogenarians."

Word from Fred H. Irons, SM '59, EE '61, via e-mail: "After taking early retirement from Lincoln Laboratory in 1989, I returned to teaching at the University of Maine to have a base of activity and to enjoy the fruits of teaching and working with young people. My position has the distinction of being the first actively endowed professorship in the electrical engineering department at the University of Maine—the Roger Castle and Virginia Averill Professorship. It entails additional responsibilities that have proven to be interesting from an educational point of view. One student is cho-

team on Chicago's Central Area Circulator, a new rail-transit line designed to improve access to Chicago's downtown Loop area. Welborne was previously a principal and VP with Sasaki Associates, Inc., in Watertown, Mass. . . Jack DeBartolo III, SM '94, is an architect with William P. Bruder in Phoenix,

sen every year from the sophomore class to be known as the Castle student. Funds are made available for the student to buy parts and work on any project in consultation with the Castle professor. I have three students in the pipeline and two graduates. I am really enjoying this aspect of my current job. During the annual engineering college banquet last October, I received the 1994 Ashley C. Campbell Award, the highest honor the college confers to faculty for 'dedication and contributions to the education of engineering students.' It was a surprise to me as past recipients have all been long-term members of the faculty. Along the way, I wrote a new textbook for sophomore circuit theory. The text is currently in its second printing at the University Press." . . . William L. Adams, SM '56, returned last year after living in Moscow for three years as head of ABB Joint Venture in the pulp and paper industry of Russia. "I retired from ABB and am now consulting on business in Russia, strategic product planning, and engineering management. . . Lynden U. Kibler, SM '56, was elected vice chairman of the board of trustees of the New Jersey State College Governing Boards Association. He is also a member of the board of trustees of Trenton State College.

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## VI-A INTERNSHIP PROGRAM

Upon his acceptance of the VI-A Directorship, I invited Professor Markus Zahn, '67, SM '68, EE '69, ScD '70, to be a contributor to this column anytime he wishes. For this issue he has obliged with the following material:

"As the seventh director in the 77 years of the VI-A Program and a graduate of the VI-A Program with Raytheon Co., I have personal knowledge of the positive benefits of VI-A, but I am also aware of some possible deficiencies that can arise. As the new director, I wanted to get to know all the VI-A students and to transmit praise and legitimate gripes to the companies, the EECS Department, and the MIT administration as appropriate in order to maximize the educational benefits to all students. To this end I read all mid-term and final reports and employer's evaluations and invited all 200 students presently in the program to meet with me individually. I suggested the following issues as possible problem areas:

- a) living and transportation arrangements;
- b) recreational, cultural, and social opportunities;
- c) work environment and company administration;
- d) quality of work assignments and freedom to select work assignments;
- e) financial considerations;
- f) ability to obtain thesis topics and find an MIT thesis advisor;
- and g) communications with VI-A office and faculty advisor.

"I also reviewed the personal VI-A folder of all students and advise them of their progress through the VI-A and M.Eng. programs. It is a pleasure to report that most VI-A assignments were stimulating, challenging, and educationally worthwhile. For the few assignments that did not meet expectations, I am assessing the problem areas and trying to get the companies or MIT to remedy the situation so that they do not recur. The major problem area that remains is the tuition payment students are required to pay to MIT during their academic-



# Prize-Winning Product Gives New Company a Foot in the Door

Software entrepreneurs are not uncommon in the MIT community—nor are up-to-the-minute Internet exploiters. And they don't necessarily wait until they have degrees in hand to launch their enterprises.

Take, for example, Rajat Bhargava, Matthew Cutler, Matthew Gray, and Eric Richard, all Class of '95—founders of the net.Genesis Corp. and some of the latest entries in MIT's history of youthful entrepreneurs. These fledgling businessmen—the oldest is 21—have entered the growing market of on-line information services that are targeting the community of Internet users connected by the World Wide Web, aka the Web.

The Web's structure resembles a molecule: thousands of individual servers (computers storing text, audio, and video data) scattered around the globe like atoms, connected by the communications pathways of the Internet. Once you have a server's electronic address, you can tap into all the files and documents it contains. What makes the Web unique, however, is that it supports high-speed electronic links among files, regardless of their locations. These links, called hyperlinks, appear as highlighted words or phrases in a document; clicking on a hyperlink enables the user to retrieve related files from any worldwide location.

For example, a scientific paper on the migratory patterns of Canadian snow geese that resides on a Web server in Toronto could include a hyperlink to ornithological research on a server in Seattle. Or to a collection of bird drawings on a server in Alaska. Or to an audio file of bird calls in British Columbia.

The net.Genesis team worked with the Student Information Processing Board to set up SIPB's Web server, then went on to develop net.Genesis's first

on-line product, the Sports Information Service (SIS)—a clearinghouse of sports news, facts, and features. Offering up-to-date information on the National Basketball Association and the National Football League, it includes daily schedules, game summaries, league standings, statistics, player profiles, trade reports, and draft results.

To advertise SIS, net.Genesis relied on word of mouth and postings to various on-line news groups. By the end of 1994, the sports service handled 10,000 daily requests from sports fans around the world, and user interest keeps growing. Though the Web's protocol makes it difficult to calculate how many individuals they are serving (if a user dials up and asks for football scores and for the game schedule in basketball,



net.Genesis

for example, that counts as two "requests"), company founders remain confident about the software's commercial potential. Winning the Entertainment Site prize in the Best of Web '94 awards in Geneva, Switzerland, last May certainly gave that confidence a boost.

"[SIS] had information that people could actually use—real-world information, and a lot of it," commented awards organizer Brandon Plewe.

The net.Genesis group is now overhauling SIS software to automate its data retrieval capabilities and to make it adaptable for any sport, from basketball to cricket. Right now, SIS is not an income source for net.Genesis, but the company plans to launch it as a commercial product in mid-1995. Instead of charging access fees, the company expects to sell advertising space to a

corporate sponsor.

SIS is only the first step. Using the sports service as an example of its cyberspace expertise, net.Genesis is contracting with commercial enterprises to provide software tools and consulting services for creating and maintaining on-line systems. (For example, the company developed a "homepage" on the World Wide Web that helps *Technology Review* connect with its audience, address <<http://web.mit.edu/techreview/www/>>.) Bhargava says net.Genesis is also talking to major corporations and has signed a contract with a major broadcasting network, although he was unwilling to elaborate at press time.

While the undergraduates initially funded their start-up costs from personal savings, they recently raised enough seed capital from investors to move the company to the next level of development. Bhargava expects net.Genesis to be hiring employees and to become profitable by mid-year. Eager to pour all their energies into the company, Bhargava, Richard, and Cutler all accelerated their course schedules to finish the requirements for bachelor's degrees at the end of last semester.

The business is getting an added boost by drawing on the talents of the greater MIT community. Bradley Feld, '87, SM '88, who started his own software and network integration firm—Feld Technologies—while a student, serves on the net.Genesis advisory board. Joe Hadzima, '73, SM '77, is the company's lawyer. And the student-businessmen continue to seek advice from the peers and faculty who surround them.

"We recognize there is a lot to be said for age and experience," admits Gray. Youthful verve and determination isn't too shabby, either.—CARL GUESS □



term work assignment in their graduate year. I am encouraging all the VI-A companies to offer some tuition assistance during this term. I'll report back to you in future issues on my success rate.—*Markus Zahn*

With the spring selection period for a new VI-A class not far ahead (as I write in December) Professor Zahn and Lydia Wereminski are busy planning the annual business meeting, revising the pamphlet and brochure, and talking with our companies about their hiring plans. I will tell you of 1995's prospects in another column.

Visiting the campus for two days of Placement Office interviews were **Chester M. Day, Jr.**, '57, SM '58, and **Neil M. Haller**, '57, SM '59, EE '61, both of Bellcore, with whom I went to lunch. "Chet" informed me he planned to retire at the end of December 1994. This reminded me how long I've been around, as I knew Chet's father, the late **Chester M. Day**, '28, SM '29, who was with New England Telephone & Telegraph back when I was with the Bell System prior to joining MIT. I came here in February 1956. Along these same lines, a chance meeting at my hometown bank with **Marion B. Reine**, MA '65, PhD '70 (VIII), longtime coordinator of VI-A at Loral Infrared & Imaging Systems, Inc. (formerly Honeywell Radiation Center), disclosed that his son, currently a junior at RPI, is taking a course there taught by Professor **Edward W. Maby**, '73 (VI & VIII), SM '75, PhD '79, whom I used to visit at RCA Labs when he was on VI-A assignment. Small world.

In the "honors & awards" category, national winners of the British Marshall Scholarships have just been announced, and VI-A grad student **Lik Mui** is one of three from MIT (37 nationwide). Lik is VP of our Eta Kappa Nu Chapter, to which I am still faculty advisor. This year the EECS Department continued its MasterWorks Program of oral presentations of master's theses, which was so successful when started last year. Two VI-As are among this fall's winners: **Akbar A. Moolji**, '93 (VI & VIII) and **Benjamin Van Roy**, '93.

A notice in the IEEE Boston Section's *The Reflector* about the Bose Institute course in "Digital Signal Processing: Principles and Applications" lists one of the instructors as **Paul E. Beckmann**, '89, SM '89, PhD '92. In the same publication is a notice of a meeting of the Antennas & Propagation Chapter to be addressed by **Carey M. Rappaport**, '80 (VI, XVIII), SM '82, EE '82, PhD '87, of Northeastern University, on "Examining the Berenger PML Absorbing Condition as an Anisotropic Lossy Mapping of Computational Space".

Visitors signing our VI-A Guest Book since the last issue: **Vincent W. Chan**, '71, SM '71, EE '72, PhD '74, of MIT's Lincoln Laboratory; **John D. Chisholm**, '75, SM '76, located in Menlo Park, Calif.; **Alan H. Katz**, '75, SM '76, from Metairie, La. Alan is a lawyer with Entergy Services, Inc., in New Orleans, having received his law degree from Tulane University following MIT.

My e-mail address is starting to provide much increased VI-A alumni/ae contact: I have heard via that channel from: **William E. Keefe**, '35, SM '35, <bllkeefe@aol.com>, who recalls Professor **William H. Timbie** as VI-A director and Professor **Karl L. Wildes**, SM '22 (XVIII), as his assistant and remembers lectures by Professor **Vannevar Bush**, EGD '16, on job hunt-

ing (times haven't changed); **Alan M. Marcum**, '78 (XV), '79, SM '79, <alan\_marcum@next.com> loves his work, enjoys son Joshua, and expects more family in mid-March; and **Andrew F. Potvin**, '92, SM '92, <potvin@mathworks.com>, whom I met in the Infinite Corridor, here recruiting for Math Works, Inc., Natick, Mass., where he works as a controls specialist.—**John A. Tucker**, director (emeritus) VI-A Internship Program & lecturer, MIT, Room 38-473, Cambridge, MA 02139-4307; e-mail: <jat@fenchurch.mit.edu>

## VII BIOLOGY

**John C. Sluder**, PhD '41, of Armonk, N.Y., died on August 22, 1994. No further information was provided.

*Alumni/ae may send information for Course News to <mitalum@mitvmc.mit.edu>.*

## VIII PHYSICS

**Cesar Ordonez**, PhD '86, is a research associate and assistant professor at the University of Chicago Hospital. "We had our third child, Eric Marcel, in August. So now, we have three boys. Both Carlo Jovel (9) and Paolo Emmanuel (8) were 'made at MIT,'" writes his, Rowena J. Torres-Ordonez, SM '81, PhD '86 (X).

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## X CHEMICAL ENGINEERING

**Werner B. Glass**, SM '51, ScD '56, is on the road "keeping busy visiting grandchildren dispersed across the country: Missouri, Illinois, and Washington." . . . On the move as well is **Charles P. Marion**, ScD '52, who writes: "Jane and I celebrated our 30th wedding anniversary at a family party in Mamaroneck, N.Y., given by sons Peter and Toby (Guy T. Marion), SM '71, who were both born while we were at MIT. Together with their wives, Marjie and Eileen, and our grandchildren, they came from Madison, Wis., and Dallas, Tex. Also present were **Charles L. Kroll**, SM '49, ScD '51, and **Robert Tobe**, SM '49, with their wives, from Noank, Conn., and Seattle, Wash., respectively. Now Jane and I alternate between our Nonsuch-30 sailboat in the summer and our 23-foot motor home in the winter. Jane drives the motor home to San Benito, Tex., at the mouth of the Rio Grande, and we sail up the New England coast in the Nonsuch, a catboat with a wishbone boom. Last summer, Toby and his family joined us in cruising as far east as Monhegan Island in Maine after embarking at Marblehead, Mass." . . . An update from **Rowena J. Torres-Ordonez**, SM '81, PhD '86, in Aurora, Ill. ("home to Wayne's World!"): "After my PhD and brief postdoc at MIT, I moved to Delaware, where I did a postdoc from 1987 to 1989 with **Michael Klein**, ScD '81, at the University of Delaware. Then I moved to the midwest where I worked as a

research engineer at the Amoco Research Center in Naperville, Ill. I currently work in environmental research, primarily in air-pollution control and waste minimization. My husband, **Cesar Ordonez**, PhD '86 (VIII), is a research associate and assistant professor at the University of Chicago Hospital. We had a third child, Eric Marcel, in August. So now we have three boys. Both Carlo Jovel (9) and Paolo Emmanuel (8) were 'made at MIT.'" . . . **Jeffery Butterbaugh**, PhD '90, sends word: "I am a senior staff scientist in new product development at FSI International in Chaska, Minn., where I am responsible for developing next-generation cleaning equipment and processes for the semiconductor industry. Donna and I also would like to announce the birth of Mitchell Wayne on April 30, 1994. Cassandra and Brandon are both proud of their baby brother."

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## X-A PRACTICE SCHOOL

Just "to illustrate what can happen to a Practice School graduate in later life," **Bayard T. Storey**, SM '55, reports his participation in the Seventh International Meeting on Spermatology in Australia last October. The meeting got its money's worth: Storey, who is professor of reproductive biology and physiology at the University of Pennsylvania Medical School, both presented a plenary address and chaired a symposium; unfortunately, he doesn't describe any other adventures Down Under. . . . **George O. G. Lof**, ScD '40, reminds us (and perhaps also has to remind himself) that he is officially retired from Colorado State University. He continues work at the university's Solar Energy Applications Laboratory, and he's also designing motorized covering systems to save energy costs associated with large indoor swimming pools—a project for his son's company, Lof Energy Systems.

The death in State College, Pa., of **David D. Locke**, SM '37, on April 1, 1994, has been reported to the Alumni/ae Association; no details are available.—**John Mattill**, *Technology Review*, Room W59-200, MIT, Cambridge, MA 02139; or send news to Carol Phillips in the SCEP office, MIT Room 66-309;

## XI URBAN STUDIES AND PLANNING

**Bette Woody**, PhD '75, writes: "I am a visiting professor at the University of California/Berkeley this year. In 1993, I was a contractor for the U.S. Department of Labor's "Glass Ceiling Commission" research, and my new book, *Black Women in the Workplace*, has been published by Greenwood Press. . . . **Martha Lampkin Welborne**, MCP '81, MAR '81 (IV), was promoted to director of planning for the Los Angeles office of Skidmore, Owings & Merrill. Most recently, she led the urban design team on Chicago's Central Area Circulator, a new rail transit line designed to improve access to Chicago's downtown Loop area. . . . From Florida, **C. Dean Sperantas**, SM '87, sends word: "I was recently issued additional responsibilities as CFO and project director for redevelopment of Hurricane Andrew-stricken Homestead, Fla. . . . And



# Covering the Waterfront ... With Recycled Milk Jugs

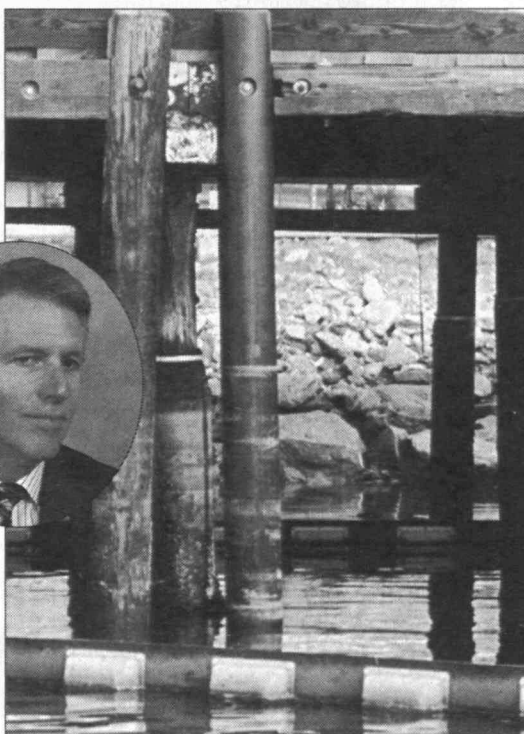
MIT management and engineering faculty are determined to strengthen U.S. industrial performance through enhanced education in engineering design and manufacturing. Many MIT alums, of course, are out there showing the way. Case in point: Frank March, '67, SM '68.

For anyone who's ever dived off a dock or waited on a pier, the wooden piling, raked and silvered by sun and waves, is a piece of the open water's romance. Millions of pilings support wharves, mark channels, and guide ships into their moorings. They make our waterways work.

They also cause a startling amount of damage to the environment. Mature pines must be felled. Their stripped trunks are treated with either creosote, a carcinogen, or CCA (copper, chromium, and arsenic) to prevent rot. The manufacture of both treatments creates toxic waste, and both ooze into the water from treated pilings.

Wooden pilings also cost a lot more than they used to. Due to recent environmental regulation, deteriorated wooden pilings treated with creosote or CCA must be disposed of as toxic waste, a much more expensive undertaking than traditional burning or dumping. Moreover, ironically, environmental regulation in general has led to healthier waterways where shipworms, gribbles, and other marine borers thrive and gnaw through pilings at about 10 times the rate they did in the early 1970s. Port managers must either replace pilings more often or wrap them in plastic sheeting, a labor-intensive and often short-lived fix.

"Seapile," a piling made from recycled plastic, is proving itself to be a cost-effective way to address environ-



*To create their line of environmentally friendly marine pilings, Frank March and his company had to find new ways to extrude and cool molded plastic and even had to develop their own reinforcing rods. The grist for their innovative mill is the yield of thousands of recycling bins.*

mental concerns, according to one of its creators, Frank A. March, '67, SM '68 (chemical engineering and ocean engineering, respectively), president of Seaward International, Inc., in Clearbrook, Va. Seapile, looking like a wrapper-less black crayon enlarged to 13 inches in diameter and up to 105 feet long, went on the market in January 1994. First-year customers include the Navy, the ports of Los Angeles and New York, the Army Corps of Engineers, and the Coast Guard.

In conversation, Frank March comes across as straight-shooting but modest. His company had been manufacturing marine fenders, buoys, and coatings when he and colleagues first

came up with the idea to make pilings from recycled plastic in 1992. They knew it would not be an easy sell. Nobody had ever made the same structural demands of recycled plastic—or, indeed, of virgin plastic—that they were proposing. So March visited ports and navy bases, asking marine engineers what would convince them to give up wood in favor of recycled plastic, and set about meeting those requirements.

Plastic, obviously, doesn't seep creosote or CCA or tempt shipworms. But any new pilings, the engineers said, would also have to match wood in withstanding the pounding of pile hammers, resisting damage from ultraviolet light and saltwater, and taking bolts and other fasteners. It also must be available, like wood, in non-segmented lengths specified by the customer. And all this at a competitive price.

March believed that the answer was a solid piece of extruded plastic roughly the same diameter as a wooden piling—a feat beyond the capability of then-available technology. Determined to break through prevailing limits, March and Seaward Vice-President Robert Taylor holed up for two days of brainstorming with Russell Gould of RG Associates, Des Plaines, Ill., a consultant to the plastics industry. "I've been involved so many times with people who say they want to do something different," says Gould, but when an innovative strategy is proposed, "their first reaction is, 'Oh, no, no, no—that won't work.'" But he found that "Frank is very uninhibited about coming up with new processes."

March wanted to use post-consumer recycled plastic—milk jugs, detergent bottles, and the like—which



## Covering the Waterfront

is about half the cost of virgin plastic resin and cheaper than post-industrial recycled plastic. But it is also less consistent in quality, piece size, and the presence of additives. With existing extruder designs, inconsistent input could translate into piling riddled with weak spots. March's team countered these conditions by re-designing the feeding and blending screw inside the extruder and developing a new protocol for the addition of blending materials. (Citing a pending patent, March won't give specifics about this or other Seaward technology innovations.) March's team also came up with a new process downstream of the extruder die that extracted heat from the Seapile fast enough for the large-diameter plastic to solidify uniformly.

Perhaps the most impressive innovation, though, was the company's success in running reinforcing bars, "rebars," like the ones used in reinforced concrete, lengthwise through the Seapile. That step presented the team with two major challenges: how to keep the rebars in position until the molten plastic cooled, and how to get the rebars and the plastic to bond. The first problem was solved with an innovative die design that emerged during brainstorming. But the team struggled with the second problem through early test production. "The first fiberglass rebar we tried you could push out of the Seapile with your finger," says March. "We did hundreds of tests but we could never find an existing rebar that would work. So we ended up making our own, using a process that's different from anyone else's."

Within a year, the Seaward team had a product that answered all of the marine engineers' original demands: a solid cross-section of foamed plastic shot through lengthwise with eight rebars (steel rebars for vertical, weight-bearing piles; fiberglass for piles installed along pier edges as

fenders), the whole covered by a tough outer skin, also fabricated from recycled plastic. About 240 one-gallon milk jugs go into a linear foot of Seapile.

The synthetic piling is actually better than wood. For starters, it can absorb about three times as much energy, so it's less likely to snap under stress. Its slippery skin causes less damage to ships' paint and makes it harder for ice floes to grab and fracture the piling. If a Seapile should snap, it can be recycled, saving the cost of wood pilings' disposal as toxic waste. Although the purchase price of Seapile is typically three times that of wood, its lifetime cost is significantly lower.

The Port of Los Angeles (POLA) is scheduled to install about 2000 Seapiles as bumpers protecting concrete bearing piles on an expanded container ship wharf. Vernon Hall, LA's chief harbor engineer,

says that POLA has been wrapping its wooden pilings in plastic for decades and was on the lookout for products made from recycled plastic. "I was impressed by the fact that Seaward thoroughly applied science and engineering to their manufacturing of the Seapile," says Hall, "and so far it's lived up to our expectations."

Seapile's early marketing success has led March to produce a square version, Seatimber, suitable for such applications as the wooden members that form the edges of wharves. On the drawing board are designs for railroad ties and telephone poles, both currently made of wood treated with creosote.

For those who worry that a slick plastic piling will rob the waterfront of its romance, Frank March has an answer: by refining the shape of the extruder die and the pigment mix, he can make a plastic piling that looks just like wood. Except to a gribble. □

—Leslie Brunetta



with hometown news from Boston, Bruce D. Ehrlich, MCP '87, writes: "I am senior project manager with the City of Boston Public Facilities Department."

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## XII EARTH, ATMOSPHERIC AND PLANETARY SCIENCES

"I had a great semester on sabbatical with my brother at Princeton, timing pulsars for the Gamma Ray Observatory," writes Hal Taylor, SM '62. "I enjoyed my first trip to the National Radio Astronomy Observatory at Green Bank, W.Va., where we observed about 50 pulsars with the 140-foot telescope over a three-day period. I returned to teaching at Stockton College in January 1995." . . . Word from Robert J. Conzemius, SM '90: "I am an air-quality scientist at Barr Engineering Co. in Minneapolis, Minn." . . . Robert Houze, SM '69, PhD '72, who is professor of atmospheric sciences at the University of Washington, announces his latest publication: "a book on the nature of clouds in the earth's atmosphere entitled *Cloud Dynamics*. It is for advanced students and researchers working on all aspects of the earth's weather and climate." The 570-page volume is published by the Academic Press in San Diego.

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## XIII OCEAN ENGINEERING

Word from Professor Henry Marcus, SM '67, in Hawaii: "I am enjoying my sabbatical from MIT. I am at the University of Hawaii as the holder of the Matson Chair for Visiting Professors." . . . Captain Lawrence K. Donovan, SM '71, writes "I retired from the Navy in 1985 and have been recently promoted to VP and operations manager of both Bechtel National, Inc., and Bechtel Environmental, Inc. I work in Bechtel's San Francisco headquarters and live with my wife, Judi, in Walnut Creek, Calif." . . .

R. Malcolm Fortson III, OCE '74, SM '74 (XV), sends word: "I am the director of a community-based quality improvement organization—Virginia Peninsula Total Quality Institute. I also work part-time with the local Anheuser-Busch brewery to train operators in continuous improvement problem-solving methods." . . . "I oversee the production and testing of various classes of Navy and Army ships and craft including amphibious assault ships and AEGIS destroyers," writes Captain Joseph A. Carnevale, SM '80, OCE '80, who is supervisor of shipbuilding in Pascagoula, Miss. "Currently, I am supervising construction of several oceanographic research ships, one of which will be operated by Woods Hole Oceanographic Institute." . . . Mark J. Underwood, SM '83 (II), OCE '83, who retired from active duty in the U.S. Navy last September, has joined AMI International, a naval analysis and consulting firm, as VP and senior analyst. A professional engineer in the states of Virginia and Washington, he is also active in the American Society of Naval Engineers (ASNE) and the Society of Naval Architects and Marine Engi-





*Left: The New England Observer Delegation to Haiti at the Palace awaiting President Aristide's return. Back, left to right: Chris Tilly, PhD '89, Tom Reeves, Peter Elikann, Tracy Hunt, MIT Lecturer Mel King, Byron Rushing, Rose Toussaint; front: Marie Kennedy, Bazelaïs Jean-Baptiste, Cathy Hoffman. Right: Tilly (far right), and friends join in a procession welcoming back the exiled Chevannes Jean-Baptiste, founder of the Papaye (Haiti) Peasant Movement. (See Course XIV)*

neers (SNAME). . . . Stephan Billian, SM '88 (II, XIII), completed a five-month internship with Matson Navigation Co., a shipping company operating container ships between the West Coast and Hawaii. He is currently assigned to the Coast Guard Marine Safety Center, Hull Division/MODU Branch in Washington, D.C. . . . From San Diego, Calif., John Kusters, SM '92, OCE '92, writes: "I am serving as navigator/operations officer on the USS *Louisville* (SSN-687). Recently, I was promoted to lieutenant commander and will be transferring to the Navy's oceanographer community in 1995."

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## XIV ECONOMICS



**Thomas Malone**

The American Association for the Advancement of Science (AAAS) has awarded Thomas F. Malone, ScD '46, the 1994 Award for International Scientific Cooperation for his "extraordinary commitment to protecting and preserving the global environment" as well as his role as "a key figure in the leadership, development, and organization of many principal international organizations that promote and foster international cooperation." Malone, who is director of the Sigma Xi Center in Research Triangle Park, N.C., was a prime mover in the development of the Global Atmospheric Research Program in the 1960s and the International Geosphere-Biosphere Program in the 1980s. A Sigma Xi news release notes his past awards, which include the St. Francis of Assisi Prize for the Environment for his "role as initiator of

major international and interdisciplinary research programs" and the Gold Medal of the World Meteorological Organization for "scientific eminence and work in international meteorological organizations." Malone was elected the first secretary-general of the Scientific Committee on Problems of the Environment sponsored by the International Council of Scientific Unions in 1970. As foreign secretary of the National Academy of Sciences during the 1980s, he established its Committee on International Security and Arms Control, which carried on a productive dialogue with the Soviet Union's science academy. . . . Chris C. Tilly, PhD '89, has been awarded tenure and promoted to the rank of associate professor at the University of Massachusetts/Lowell. He joined the faculty of the Policy and Planning Department of the College of Management in 1988 and has written on labor market issues such as part-time work, earnings inequality, and racial discrimination. Recently, he was coauthor of a report on women and poverty for the Women's Statewide Legislative Network. Last October, Tilly spent six days in Haiti as a member of the New England Observers' Delegation, a group of officials, educators, health workers, and activists invited by President Jean-Bertrand Aristide's Boston consul to witness his return.

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## XV MANAGEMENT

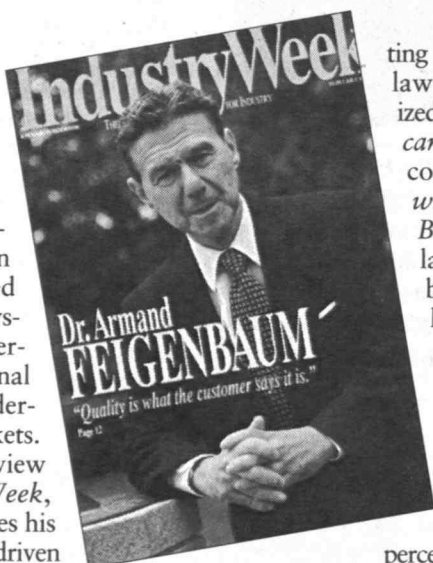
Richard Wood, '48, writes: "Since I bought out my Chicago partner in 1987 and moved the company to Boston, I've lived in Cambridge, where I find there are a lot of retired and still-working MIT graduates. I'm still active in my company, which finances and manages 80 government-subsidized low-income housing projects located in 15 states, and I still have the time to travel to Europe and visit with my five grandchildren." . . . James A. Stoner, SM '61, PhD '67, was invit-

ed as guest lecturer for the 25th anniversary celebrations last November at the Universidad Ricardo Palma in Lima, Peru. "The theme of the sessions was the adoption of the global quality management paradigm as the strategic priority for Peruvian companies," he writes. "I presented several lectures, led a seminar, and opened an exhibition of Peruvian products at the University." . . . News from Sharon Burns Holcombe, SM '74, in Milford, N.H.: "I recently married David B. Hinkley and am currently working with Burns Industries to get established in contract work in areas of electro-mechanical assembly, engineering, and prototyping. We are located in a classic old factory building in Lowell, Mass." . . . R. Malcolm Fortson III, SM '74, OCE '74, sends word: "I am the director of a community-based quality improvement organization—Virginia Peninsula Total Quality Institute. I also work part-time with the local Anheuser-Busch brewery to train operators in continuous-improvement problem-solving methods." . . . From Westport, Conn., Frank Basler, SM '75, writes: "I have my own organization development consulting practice specializing in work redesign (sociotech). I developed a new workshop called 'Managing Resistance to Change,' which was inspired as I completed my training for certification as a psychoanalyst this past year." . . . John C. Wehner, SM '83, is currently manager of fuel and economic forecasting at the FPL Group, Inc., and chairman of the Edison Electric Institute Economics Subcommittee in Palm Beach, Fla. . . . "This has been a challenging year," writes Usman A. Ghani, SM '91 (XV & TPP), SM '92 (MOT), "I successfully managed several major projects including an advanced consulting skills workshop for a global telecommunications company, a targeted-solution selling program for a global information company, an integrated competency development program for a large airline, intensive executive education sessions for a leading telecommunications firm in the Far East, and three extensive reengineering projects through various stages. My article on making reengineering work will be published by the *AMA's Management Review*. It takes a holistic approach to implementing 'Re' changes. I was also inducted into the *Who's Who Worldwide* registry and am now a life member of its Executive Club." . . . Michael P. Chaudhri, SM '91, is "enjoying life in northern California." Currently product manager for workgroup servers at Apple Computer, he is active with rock climbing, sea kayaking, and flying. "Visitors are always welcome," he adds. . . . Jai-Kue Park, SM '92, and his wife, Susan Kim, who just finished a PhD in sports marketing at the U.S. Sports Academy, announce the arrival of their second son, Justin. . . . Daniel C. Oakley, SM '92, sends word from Old Westbury, N.Y.: "Eileen and I announce the arrival of our second daughter, Rae Moore Oakley on August 28, 1994. The brood is growing!"

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# Totally into Quality

**W**hen Armand V. Feigenbaum, SM '48 (XV), PhD '51 (XIV), wrote *Total Quality Control* (McGraw-Hill, Inc.) in 1951, he predicted that total quality systems would determine an international corporation's leadership in world markets. In a recent interview with *Industry Week*, Feigenbaum outlines his concepts of results-driven quality and management strategies that have been the mainstays of his work with Union Pacific Railroad, IBM, Citicorp, Ford, Cummins Engine, Toshiba, Hitachi, Renault, Fiat, Phillips, and Pirelli Brazil. "Quality does not travel under a single passport," he notes. "Quality levels the playing field. It's a very tough thing for some American companies to understand that even if you don't have any foreign competition or don't have any interest in export today, you need to quickly develop and offer your products and services as if you were get-



ting some. Murphy's law, internationalized, says that if you can get foreign competition, you will." Last year, *Business Week* lauded Feigenbaum's \$18 million consulting firm, General Systems Co., for aiding Tenneco in whittling its cost of quality from more than 20 percent to 14-15 percent, adding \$461 million to its operating income in two years. Feigenbaum, who started his career as an apprentice toolmaker at General Electric, is still "desperately seeking ways to do a better job" for himself and for others. Last summer, he was in Singapore to award the Dr. A.V. Feigenbaum Gold Medal at the Ngee Ann Polytechnic graduation ceremony, and last fall, at the Massachusetts State House, he awarded the 1994 winners of the Armand V. Feigenbaum Massachusetts Quality Award. □

—Elizabeth Fullon

## SENIOR EXECUTIVES

The Association of Alumni/ae has been notified of the following deaths: Carl H. Krieger, '60, of Salt Lake City, Utah, on May 9, 1993, and Sten E. Porrvik, '69, of Sundsvall, Sweden, on March 29, 1990. No further information was provided.

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## MANAGEMENT OF TECHNOLOGY

Joe Gilman, SM '90, is now in Brussels as VP for Business Planning for BellSouth Europe. He and his family are enjoying their new home in Waterloo and he hopes to meet with the current MOT class when they visit Brussels during the International Field Trip. . . . Mel Arnold, SM '91, visited Boston during the first week of December to attend a conference at MIT on the "Lean Aircraft Initiative." Mel is now the Air Force representative for the pro-

ject. Mel and Audie E. Hittle, SM '91, arranged a dinner last December for all MOT alumni/ae in the Greater Boston area. Among the alumni/ae who attended were Audie and his wife, Karina, Kathy Kessel, SM '88, Tom Heller, SM '91, Soo Sheung Wong, SM '91, with her husband, Hauke Kite-Powell, '84 (XIII), SM '86 (XIII), SM '88 (TPP), PhD '92 (XIII), Usman Ghani, SM '91 (XV & TPP), SM '92 (MOT), Peter Dunbeck, SM '79 (XVI), SM '91, and Barney Ussher, SM '92. Mel also stopped by the Program Office to visit with Rochelle Weichman and Jennifer Mapes in the new location at E52-126.

Tak Kai, SM '92, is still working in San Francisco with Arthur D. Little, Inc. He reports on a small reunion in San Francisco last August: Gary Hight, SM '92, Koichi Hagishima, SM '92, and Ted Obbard, SM '92, met at Tak's house for an enjoyable "catch-up" session. Gary has been promoted to executive director of BellSouth; Koichi has returned to his previous lab after a two-year assignment at NTT headquarters; and Ted is

still working for Hewlett Packard in California. . . . Carl Pistorius, SM '94, writes to tell us that after returning to the University of Pretoria last June, he was appointed director of the newly established Institute for Technological Innovation at the School of Engineering. He and his family moved to a new home and are happy to be back in South Africa.—MOT Program, MIT, Room E52-126, Cambridge, MA 02139.

## XVI AERONAUTICS AND ASTRONAUTICS

James K. Marsteller, SM '47, writes from St. Louis, Mo.: "This year, I am designating my Alumni/ae Fund contribution to the Ray Bisplinghoff Fund. I was one of Ray's first three thesis students the first year he taught at MIT in 1946-47. (I am almost certain that the other two were Holt Ashley, SM '48, ScD '51, and Ted Pian, SM '44, ScD '48—both of whom went on to become professors in Course XVI—but Gabe Isakson, SM '47, ScD '53, may have been one of the two.) I opted for industry and later government, and spent my entire career in aerospace before resting five years ago. I remember flying with Ray in his Aeronca Champion when I was a student. I last saw Ray when he was chancellor of the University of Missouri at Rolla. He was a fine professor."

David M. Prongay, SM '55, retired as of January 1 this year. "After 38-plus years with Boeing—the 777 is flying!" he notes. "I am active with my local Episcopal church—I sing with the Bainbridge Chorale and Church Choir, work with the Kairos prison ministry—I keep very busy." . . . Efrem G. Malach, PhD '69, has been awarded tenure at the University of Massachusetts/Lowell. An associate professor in the Manufacturing and Management Information Systems Department in the College of Management, he joined the faculty in 1988 and was elected department chair last fall. He maintains an active consulting practice in information-systems technology and its implications and is a frequent contributor to academic and trade publications. His second book, *Understanding Decision Support Systems*, was published in 1993 and a third text is currently under contract.

From Camarillo, Calif., Edward V. Ashburn, SM '40, poses a practical problem: "Most houses in Southern California are constructed by using a wooden frame fastened to a concrete slab. Earthquakes often cause extensive damage to these structures. During the quake centered in Sylmar in 1972, my home in Granada Hills was not damaged, but the concrete slabs of the houses on either side of mine had two-inch cracks. Attempts at making houses rigid often fail. The shaking of the house cracks the walls and damages the contents, and even houses with block walls around them cannot withstand the earthquakes. My question is: Could earthquake damage be reduced if the houses were not rigid and not rigidly attached to the ground?"

Dale Stuart, '82, ScD '87, is a five-time world champion skydiver. See photo on page MIT 43.

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## XVII POLITICAL SCIENCE

Les Roos, PhD '67, is a national health scientist funded by the Canadian Department of Health, as is Noralou P. Roos, PhD '68. "We direct the \$2-million-per-year funded Manitoba Centre for Health Policy and Evaluation—and have a 26-year-old son and 7-year-old daughter."

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## XVIII MATHEMATICS

Jan List Boal, PhD '59, writes from Senoia, Ga.: "My wife, Bobby, and I are in our ninth year of innkeeping at The Veranda, a nine-room historic inn just 30 miles south of Atlanta, Ga. I retired from Georgia State University in June 1990 after 37 years of teaching. We have three children and eight grandchildren—8=2<sup>3</sup>!"

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## XXI HUMANITIES

MIT Professor Emeritus Harald Reiche died of cancer on July 25, 1994. A classical scholar,

Reiche was the author or co-author of several books and many articles on classical history and thought. He later became particularly interested in Greek cosmology and astronomy and wrote and lectured widely in that field. Reiche was born in Germany in 1922 and studied in Switzerland before emigrating to the United States, where he graduated from Philips Academy. After service in the U.S. Army during World War II, he earned AB, AM, and PhD degrees in classics at Harvard. He was appointed full professor of classics and philosophy at MIT in 1955 and helped organize, design, and teach the introductory humanities program. He also taught electives in Greek philosophy and language, ancient history, and Roman political thought.



Harald Reiche

He retired in 1991. From 1980-1990, Reiche and his wife were faculty residents in Baker House, where they hosted Sunday evening suppers and symposia famous on the campus for good food and stimulating conversation. Reiche held a Carnegie Fellowship in humanities when he was first at MIT. Later he held a Guggenheim Fellowship in Athens and a Ford Foundation visiting professorship at the Technical University of Berlin. For many years he was also a lecturer in humanities and philosophy at Suffolk Uni-

## CourseNews

versity and visiting professor at Brandeis University.

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## XXII NUCLEAR ENGINEERING

William W. Saylor, SM '77, describes his current projects: "design, fabricate, and fly advanced payloads for satellites and UAVs; develop autonomous, intelligent, miniaturized systems for defense and civilian applications."

Word from Jon Anderson, PhD '86, via e-mail: "I was recently promoted to distinguished member of technical staff at AT&T Bell Laboratories. I am currently involved with R&D of broadband telecommunications network architecture and systems modeling and am having great fun at it. This past summer I had the pleasure of returning to MIT for the Summer Professional Program (but took a Course VI offering) and had a fine time visiting old friends and being on campus again."

John Keffer, SM '88, writes: "I am a qualified nuclear engineer for the Dresden Station of Commonwealth Edison Co."

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**Shashi Kant Sharma**, SM '92 (II), (TPP '78), has a consulting and training group called Matrix Consultants. They focus upon two major areas—management and computers. Anyone looking for high-quality low-cost software development should contact him. Shashi informs us that the variety and flexibility provided by running this type of enterprise is very satisfying. Any TPPer visiting India and Pune can count upon a place to stay, hospitality, and some good company. Tennis players should bring their racquets along.

**William Dunbar**, SM '79, reports that Guam Power Authority is keeping him very busy—they are experiencing a high level of load growth due to Japanese tourism. He is also working on a periodic review of the Palo Verde Nuclear Plant (the largest nuclear plant in the U.S.) near Phoenix for the Southern California Public Power Authority (SCPPA), which has ownership interest in the project.

**James Egan**, '86 (I), (TPP '79), recently started a new Washington, D.C., law firm specializing in energy and environmental litigation. All four attorneys in his new firm are also engineers. He represents clients from 11 different countries in matters before the Department of Energy, the Nuclear Regulatory Commission and in civil litigation.

**Tatsujiro Suzuki**, SM '79, is the 1995–96 recipient of the Abe Fellowship (research grant for US/Japan researchers). The fellowship program will begin in the fall and his research topic is "Maintaining the Plutonium Technology Option: Reconciling Non-proliferation and Energy Security Concerns". . . . **Joan Winston**, '72 (VIII), SM '82, has been promoted to senior associate at the U.S. Congress Office of Technology Assessment. She has just published a brand new report for OTA entitled *Information Security and Privacy*. She also worked with **Alan Buzacott**, SM '90, on *Finding a Balance...* about computer privacy. . . .

**Paul Hauge**, SM '83, is in his third and final year at Harvard Law School and will begin a one-year clerkship with Judge Samuel Alito, Jr., of the U.S. Court of Appeals for the third circuit (Newark, N.J.) in September 1995. . . . As an assistant professor of finance at Tulane University, **Chitru Fernando**, SM '86, teaches two MBA elective courses in international finance and advanced financial management. This past summer, Chitru taught an international finance mini-course in the Czech Republic and also at the National Taiwan University in Taipei where Tulane conducts the Executive MBA Program. This summer he plans on traveling to Beijing, Hong Kong, and Taipei.

**Paquita Zuidema**, SM '87, and **Brian Mapes** were married in September 1992. Paquita is a graduate research assistant in the Atmospheric and Ocean Sciences Department at the University of Colorado.

**Jesse Baskir**, SM '88, PhD '88 (X), works in the environmental area doing pollution prevention work at the Research Triangle Institute. The institute is an organization (private, not-for-profit) of about 1,500 people doing work in a variety of areas, including a fair bit of environmental work for the EPA. Jesse

started there last September, so he writes that he is still getting up to speed. So far his work has focused on small business-related issues and wastes from painting and coating operations. Jesse is married and has two children—Carolyn is 2, and Sam is 5. . . . **Marina Pocater Silva**, SM '87, informs us that she now has two daughters (5 and 3) and is currently living in Brussels where her husband, Roberto, is the Venezuelan ambassador to the European Union. Marina joined McKinsey in 1990, after working for Deloitte Askins & Sells in Washington, D.C., for two years. Her position as associate keeps her traveling all over Europe and she is having a great time. . . .

**Sylvia Marin von Koller**, SM '88, and **Oscar** just returned from a one-month trip to India and Nepal. They attended the Bioresources '94 Conference in Bangalore, where Sylvia had a chance to visit CARE's bio-intensive gardening pilot project working in 120 villages in the south of India. They also visited Kathmandu and Pokhara in Nepal, where they enjoyed the incredible view of the Annapurna mountain range. Overall it was a great trip.

**Simon Stokes**, SM '88, is now on staff in the Oxford office of Manches & Co., a commercial law firm with offices in London and Oxford.

Since February 1994, **Erin Craig**, SM '89, has been working as director of the Northern California Business Environmental Assistance Center. It's a state-funded program within the University of California that provides environmental compliance assistance to businesses for free. Erin and her husband, Rich Dvorak, have two children. Kim is 5 and Peter is 2. . . .

**Richard Davies**, SM '84, and **Jose Stein** are losing sleep—son, Graham, arrived on November 10, 1994. Congratulations! . . . **Aaron Curtis**, SM '90, SM '91 (XV & TPP), is working with the 777 Program, documenting safety issues on aircraft and trying to remedy potential problems. He also works on safety policy for air transport.

**Paul Koch**, SM '90, just returned from Guatemala with a team of architects and engineers organized by Engineering Ministries International. Their task was to design new facilities to be used by two agencies that serve perhaps the most destitute people in Guatemala City. One particular structure was designed to support basic services (medical, teaching, and feeding) for members of a community that survives by scavenging for food and material off a municipal dump. Having completed three extended trips since his graduation in May 1994 (PhD from the University of Nebraska), he is now focusing his energies on a job search.

The family of **Susan and James Winebrake**, SM '91, is growing. Deaven Anne joined big brother, James Patrick, on December 2, 1994. Jamie completed a PhD in energy management and environmental policy from the Center for Energy and the Environment at the University of Pennsylvania in August 1994. Congratulations to Jamie on both events! . . . **James Moses**, SM '91, SM '92 (II), is now working in the Process & Tools Department (a natural home for a TPPer) at BNR/Northern Telecom in North Carolina. James recently bought a wonderful old (1945) house near the campus of North Carolina State University. . . . **Madhu Nott**, SM '91, was in Brussels this past summer and spent some time with **Jan Van Acker**, SM '91, SM '92 (XV), catching up and

talking about TPP. Jan writes that anyone traveling to Belgium should definitely give him a call. . . . **Michelle and Michael Berube**, '89 (I), SM '92 (TPP, XV) recently traveled to Australia to visit friends. . . . **Michael Goldstein**, SM '92 (I, TPP), is working on Superfund and waiting for reauthorization in the next Congress.

**Bhavya Lal**, '90 (XXII), SM '90 (XXII), SM '92, is a policy consultant with Abt Associates. Bhavya and Lukas were married in January 1993 and they live in Cambridge, Mass.

**Brian Cohen**, SM '93 (TPP, I) is an analyst at the Environmental Working Group in Washington, D.C. He recently finished his first major project—a 280-page report on pesticide contamination of drinking water, "Tap Water Blues." The paper is a big success—lots of press, particularly in the Midwest, and some pretty solid indications from EPA that they may act on some of the key recommendations. Brian strongly recommends public interest work for all TPPers—more fun (and rewarding) than he ever thought work would be. He encourages all alumni/ae interested in public or advocacy work to give him a call.

**Paul Shawcross**, '87 (XVI), '88 (XXI), SM '93, is finishing up a study on orbital debris which may make a big impact because it is the first really solid study on this topic. Paul writes that "NRC is a good place for TPP grads." . . . **Ed Cheng**, '94, is on staff at Acurex Environmental Corp. in the Alternatives Fuels Group, which focuses on mobile source emissions technologies and policy issues. Much of his work is done for CARM or regional AQMDs, and they also run a number of alternative fuel vehicle demonstrations in California.

Since joining the World Bank in July 1994, **Elisabeth Stock**, '90 (II, XXI) has been on missions to Kenya, Tanzania, Zimbabwe, and Zambia talking with people about using employment-intensive techniques in the road sector. She has also completed a first draft of a guidelines paper for the World Bank with co-author Jan de Veen from the ILP in Geneva. . . . **Christopher Hill** (TPP friend) is a professor of public policy and technology at the Institute of Public Policy at George Mason University.—**Richard de Neufville**, TPP, MIT, Room E40-252, Cambridge, MA 02139; e-mail: <tp@mit.edu>

## Deceased

The following deaths have been reported to the Alumni/ae Association since the *Review* last went to press:

**Ernest E. Polley**, '15; February 16, 1994; Denver, Colo.

**Antonio H. Rodriguez**, '21; June 17, 1994; Tampa, Fla.

**William D. Norwood**, '23, SM '24; January 9, 1994; San Jose, Calif.

**Frederick H. Reed**, '24, SM '25; October 20, 1994; Cornwall, N.Y.

**Isadore Conrad Berman**, '25; May 1989; Malden, Mass.

**Charles L. Norton, Jr.**, '25; June 3, 1993; Augusta, Ga.

**Winthrop Humphrey**, '26; November 21, 1994; Juno Beach, Fla.

**Gilbert W. Noble**, '25, ScD '36; July 10, 1993; Winter Park, Fla.



Vernon G. Rockwood, '25; September 30, 1994; Bradenton, Fla.  
 William W. Farr, '26; November 9, 1994; Southern Pines, N.C.  
 Arthur Howard Lane, '26; July 10, 1994; Brewster, N.Y.  
 David G.C. Luck, '27, PhD '32; June 5, 1994; Santa Barbara, Calif.  
 Philip N. Rugg, '27; November 16, 1994; Portsmouth, N.H.  
 George A. Bernat, '28; October 15, 1994; Sarasota, Fla.  
 Robert Cook, '28, SM '32; November 3, 1992; New Rochelle, N.Y.  
 Leon Avalos Vez, '29; 1992; Mexico  
 Daniel T. Foley, '29; November 6, 1994; Fall River, Mass.  
 Louis F. Southerland, Jr., '29; September 11, 1994; Austin, Tex.  
 Alfred T. Waidelich, SM '30; November 28, 1994; Cleveland, Ohio  
 Philip M. Allen, '32; September 25, 1994; Orleans, Mass.  
 Albert W. Dunning, '32; November 14, 1994; Yarmouth Port, Mass.  
 Charles H. Fischer, '32; May 4, 1994; Chicago, Ill.  
 Joseph C. Noyes, Jr., '32; November 16, 1993  
 William B. Klee, '33; August 12, 1994; Hilton Head, S.C.  
 Joseph C. Noyes, Jr., '32; November 16, 1993  
 Louis C. Raymond, '32, October 19, 1994; Chappaqua, N.Y.  
 Arthur C. Esslinger, '34; September 28, 1993; Southhold, N.Y.  
 Stanley S. Knight, '34, SM '35; May 12, 1994; South Dartmouth, Mass.  
 Hereward A. Reynolds, '34; June 28, 1994; Needham, Mass.  
 Aaron Shaffner, '34; January 4, 1994;

Framingham, Mass.  
 John C. Alden, '35; October 17, 1994; Concord, Mass.  
 William Gregg Fry, '35; October 10, 1994; Bridgeport, Conn.  
 Arthur J. Haas, Jr., PhD '35; February 27, 1994; Baton Rouge, La.  
 John E. Kiker, Jr., '35; June 28, 1994; Americus, Ga.  
 Adolph L. Antonio, SM '37, ScD '39; March 9, 1994; Arcadia, Calif.  
 William E. Haible, '39; December 3, 1994; Lexington, Mass.  
 John A. West, Jr., '39; September 4, 1994; West Southport, Maine  
 Joseph D. Havens, '40; October 11, 1994; Portland, Ore.  
 Richard C. Collins, Jr., '41; 1967; Saratoga, Calif.  
 Gardner M. Ketchum, '41, SM '44, ScD '49; September 25, 1994; Alexandria, Va.  
 John C. Sluder, PhD '41; August 22, 1994; Armonk, N.Y.  
 Herman R. Lorence, '42; September 1, 1994; Brookings, Ore.  
 John H. Helve, '45; April 25, 1994; Etowah, N.C.  
 John L. Hertig, '45; October 3, 1994; Arapahoe, N.C.  
 Max E. Ruehrmund, Jr., '45; June 15, 1994; Dover, Del.  
 Hillman Dickinson, PhD '46; September 2, 1994; Arlington, Va.  
 Paul J. Kiefer, Jr., '47, '49, SM '49; January 19, 1994; Annapolis, Md.  
 Peter P. Poulos, '47; December 13, 1994; Maplewood, N.J.  
 Ralph W. Hall, '50; December 10, 1994; N. Fort Myers, Fla.  
 Lawrence J. Marks, '50; 1994; Falls Church, Va.

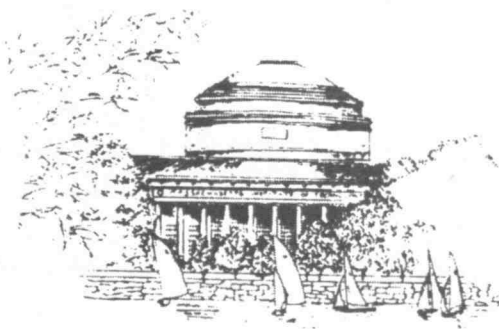
David C. Crocker, '52; November 9, 1994; Holden, Mo.  
 William T. Quinn, Jr., '52; March 10, 1994; Milford, N.H.  
 Creighton W. Cook, SM '54; August 12, 1994; Big Bear Lake, Calif.  
 Charles Ray Marcum, SM '54; September 15, 1994; Pittsburgh, Pa.  
 Josef Gross, SM '56; December 24, 1993; New Brunswick, N.J.  
 Richard M. Hornreich, '58, SM '59, EE '61; October 24, 1994; Rehovot, Israel  
 Carl H. Krieger, '60; May 9, 1993; Salt Lake City, Utah  
 Reinhold Frederick Hollender, Jr., '63; June 30, 1992; Minneapolis, Minn.  
 Robert J. Horodyski, '65, SM '68; September 2, 1994; New Orleans, La.  
 Sten E. Porrvik, '69; March 29, 1990; Sundsvall, Sweden  
 William F. Honda, '71, SM '72; November, 1991; Honolulu, Hawaii  
 David B. Feinberg, '77; November 2, 1994; New York, N.Y.  
 Henry P. Petrilli, '77; February 22, 1994; Sewell, N.J.  
 Francis X. D'Amato, '79; November 5, 1994; Glastonbury, Conn.  
 Cathy M. Comeau, '87; December 6, 1994; Chelsea, Mass.

#### Correction:

In the August/ September Deceased List, we erroneously listed the date of death of Edwin Pyle, Jr., '44, as March 16, 1996. The year should have been 1994. Our apologies for the error.



## HERE MIGHT A NAME BEST LIVE?



The name of a deceased MIT alumna or alumnus can be linked to the Institute through gifts made by classmates, colleagues and family. Memorial gifts can be unrestricted or directed toward scholarships, research or any program of the Institute. The Institute notifies bereaved families of the name of each donor, and each gift becomes a part of MIT's permanent record.

Named endowed funds whose income supports the work of the Institute in perpetuity can be established with larger gifts. If you would like information on ways of expressing sympathy through a memorial contribution, or on establishing a named endowment fund, please contact Betsy Millard, MIT Room E38-202, Cambridge, MA 02139 or call (617) 253-8059.

# PuzzleCorner

It has been a year since I specified the size of the backlogs for the various kinds of problems that are printed. Currently, I have a multi-year supply of regular problems, and over a year of speed problems. Bridge problems, however, are in short supply, and I have no chess or go problems. Computer problems are now considered regular problems.

I write this issue the first business day of the new year and wish you all a healthy and productive 1995. This year will include a personal milestone for me: I was born in 1945, so will cross into my second half-century this August.

## Problems

**Apr 1.** Winslow Hartford sends us the following Sheinwold problem in which South is declarer at 6 hearts and is to make the contract against a lead of the D7.

		North	
		♠	Q 10 8 6 3 2
		♥	A J 4
		♦	4 2
		♣	Q 7
West		East	
♠	9 7 4	♠	K 5
♥	8 7 6 5	♥	None
♦	7	♦	K J 9 6 5 3
♣	K 6 4 3 2	♣	A J 10 9 8
		South	
		♠	A J
		♥	K Q 10 9 3 2
		♦	A Q 10 8
		♣	5

**Apr 2.** Nebraska was just named the national champion in college football, bringing great cheer to Lincoln but much sadness to State College. Jerry Grossman asks us to show that round-robin tournaments always have at least one player "transitively better" than everyone else. Specifically, Grossman writes:

A round-robin tournament was held among  $n$  players, each player playing



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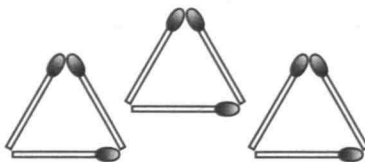
one game against every other player. No game ended in a tie. Show that there exists a player  $K$  such that for every other player  $L$ , either  $K$  beat  $L$ , or  $K$  beat someone who beat  $L$ .

**Apr 3.** Robert Moeser has one that he suggests you solve by hand for  $N \leq 5$ , but use a computer if you want to try larger  $N$ . Use  $N$  identical cubes and create a solid object by joining them only by gluing a face against another face such that the two faces are in perfect alignment. Consider that two such objects are identical if one can be rotated and placed in exact correspondence with the other. (Objects that are mirror images, however, are considered different.)

How many different objects can be made with  $N = 1, 2, 3, 4, \dots$  cubes?

## Speed Department

**Nob.** Yoshigahara wants you to move two matches so that no triangle remains.



## Solutions

**N/D 1.** Larry Kells writes that while kibitzing a high-stakes game, he saw declarer bid and make 7 no-trump redoubled and vulnerable. In the aftermath, the defenders, a married couple, were arguing heatedly:

*Wife:* How many times do I have to tell you to stop making those risky speculative doubles? You've cost us thousands of dollars that way!

*Husband:* But I had 26 points. I thought I could beat 7 no-trump.

*Wife:* You see perfectly well that we had no defense. Next time don't double 7NT in that position unless you have all four suits completely stopped!

Assuming they were both telling the truth, reconstruct the deal.

The following solution is from Len Schaidler: Let South be the declarer at 7NT redoubled; East is the husband with 26 points; West is his wife. E/W cannot have all four aces or the contract will be defeated. Since West has 26 points, N/S cannot have all the aces. If N/S have only one ace, they would need 13 cards in that suit to win, but the opponents could not lead that suit!

If N/S had two aces, they would probably hold AK in two suits for the 14 points. However, this does not provide any possible solutions. What does work is for N/S to have three aces and one Q for their 14 points, and for West to be void in the suit in which East has the ace.

		North	
		♠	xxxxxxx
		♥	ATx
		♦	AT
		♣	x
West		East	
♠	(void)	♠	AKQJx
♥	xxxxxx	♥	KQJ
♦	xxxxxxx	♦	KQJ
♣	(void)	♣	KJ
		South	
		♠	x
		♥	x
		♦	x
		♣	AQxxxxxxx

Assume West leads a diamond. North plays the ace and leads a club, finessing East. South then leads the last club honor and plays the remaining eight clubs. North discards spades and red cards but keeps the AT of hearts.

After South and North play their 11th card, East has a problem discarding.

		North	
		♥	AT
		East	
		♠	A
		♥	KQ
		South	
		♠	x
		♥	x

If East discards the ace of spades, then South will play a spade and lead to the ace of hearts. If East discards a heart honor, then South will lead to the ace of hearts and the ten of hearts will be good. (Since West may still have a heart, it is necessary for North to have been dealt both red tens.)

The overall play is the same if West leads a heart; in that case both North and East will keep diamonds.

**N/D 2.** Nob Yoshigahara wants you to solve the following criptarithmic problem.

A  
AA  
AAA  
AAAA  
AAAAA  
AAAAAA  
AAAAAAA  
AAAAAAA

BCDEFGHI

The following solution is from Zale Zussman:

For any  $A \leq 4$ ,  $B=A$ , which isn't allowed under usual criptarithmic rules (3A plus carry is no more than 13, so 2A plus carry is no more than 9). That leaves only 5 digits to try for A, with the solution given whenever BCDEFGHI are all

*Continued on Page MIT 40*





# MIT LIFE INCOME FUNDS

## PROFESSOR MORRIS COHEN

HOME: Swampscott, Massachusetts

CAREER: Professor Cohen entered MIT in 1929, received the S.B. degree in metallurgy in 1933, and the Sc.D. degree in 1936. Although it was the Department of Metallurgy that he joined as a faculty member in 1937, his efforts helped transform it into the Department of Metallurgy and Materials Science in 1967 and then the Department of Materials Science and Engineering in 1975. His teaching and research advanced the understanding of the structure and properties of materials and the methods of processing them to improve their engineering performance. His research has been particularly central to the development of high-strength steels used in modern

technologies. Above all, he is especially proud of the more than 200 graduate students he supervised over the years. He still stays in touch with many of them and their families.

Named an Institute Professor in 1975, Professor Cohen received the National Medal of Science in 1977 and Japan's prestigious Kyoto Prize in Advanced Technology in 1987. He retired in 1982, but remains active both at the Institute and in matters of national materials policy. He also continues his long-time interests in impressionist art collecting and landscape gardening.

MIT LIFE INCOME FUND:  
The Morris Cohen (1933) Reserved Life Estate Fund.

QUOTE: My Retained Life Estate gift enables me to give my home to the Institute while retaining the right to live in it. I am particularly gratified that, with this disposition, I can relate my academic and domestic lives — two-thirds of a century of growing at MIT and one-half of a century enjoying my family home in Swampscott.

**For more information** about MIT Life Income Funds, write or call D. Hugh Darden, W. Kevin Larkin or Frank H. McGrory at MIT, 77 Massachusetts Avenue, Room 4-234, Cambridge, Massachusetts 02139-4307; (617) 253-3827.

Photo: Richard Howard



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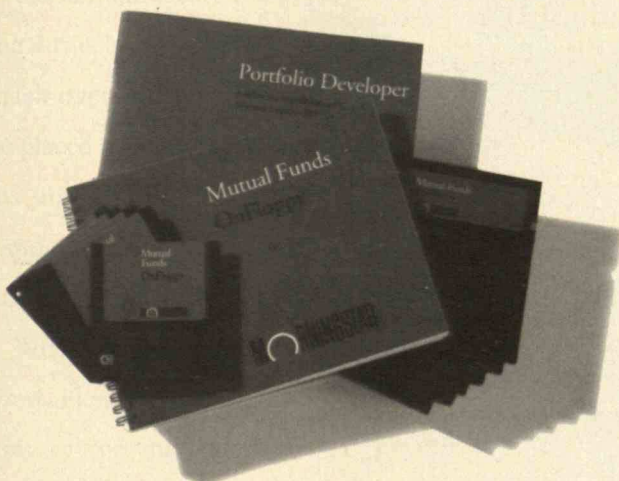
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# UNITED INCOME FUNDS

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THE baby boy came into the world at 28 weeks, gasping for every breath. He weighed 1,000 grams, a touch over two pounds. Papery wrinkles gave him the wizened look of prematurity, only skin and bones where pleasant rolls of fat would have materialized during 12 more weeks in the womb.

It was 2 a.m., Alan Fleischman's shift. That night in 1969, Fleischman, a fourth-year medical student, was serving as an intern in the pediatrics department of a New York hospital.

Fleischman cleaned up the little boy and put a mask over his face. Then he placed a small tube into his airway and, using a hand pump, forced air into his lungs.

With the baby stabilized, Fleischman carried him to the nursery. He can't forget what happened next, when he asked for a respirator. "I came back to the nursery with the baby, and the nurse said, 'We don't put these babies on respirators.'" Puzzled, Fleischman asked what he should do with the baby instead. He was told to remove the hand respirator and let the infant die. He

said, "No, I won't do that," and told the nurse he intended to stand there and continue using the hand respirator.

"She said I could stand there and do whatever

I damned please," he recalls. "And I did. At eight in the morning the professor came in. He took me into his office and explained that the reason we didn't put the baby on a respirator was because all such babies died. And it was inappropriate to make babies suffer for no benefit. Therefore, this rule had been made throughout the country, and as sad as it seemed, it was humane. Obviously, I had to give up the hand respirator when I went into his office. And the baby died while we had coffee."

December 1993, a quarter of a century later. But it could have been a millennium that had passed, so different was the face of

medicine. Once again a tiny premature baby came into the world. Once again it was on Fleischman's shift.

Now Fleischman himself was in charge—director of the Division of Neonatology and professor of

# Suffer the Little Children

*The technology that keeps younger and younger premature infants alive often merely postpones the inevitable, at great emotional and financial cost. Ethical standards for treatment must catch up with neonatal medicine.*

By STEPHEN D. SOLOMON



pediatrics at the Albert Einstein College of Medicine and the Montefiore Medical Center, in New York. He was also a fellow at the Hastings Center, a prestigious think tank devoted to the study of ethical issues, and by this time had written more than 130 papers on neonatal bioethics.

A baby boy was born at 24 weeks gestational age (full gestation is 40 weeks) and weighing a little more than a pound—a month earlier than the baby he had treated as a medical student, and half the weight. Fleischman accepted the baby into a room quite different from the nursery of the 1960s—a neonatal intensive care unit crammed, floor to ceiling and wall to wall, with the fruits of medicine's technological age.

The machines at Fleischman's elbow made the outlook quite favorable for 28-weekers; unlike a quarter century earlier, those babies not only were treated aggressively but were expected to do well. Now the focus was on 24-weekers like this infant: how aggressively should he be treated, and for how long?

Days passed and, despite all efforts, the baby fared poorly. He developed lung disease and massive bleeding in his brain. In the unlikely event that he survived, there was virtually no chance that he would enjoy any meaningful interaction with the world.

What to do? Continue treatment and the huge commitment of resources? To what end? Fleischman spoke with the family, telling them that all the technology in the world was unlikely to change the grim prognosis. "They said 'No, no, no, we want everything,'" Fleischman remembers. "So we continued aggressive treatment for another three months. The longer this kid stayed around the more sure we were of the outcome: the child would die. And he did."

### Neonatal Intensive Care

Who shall live and who shall die? A generation ago, that question asked about premature infants was easier to answer. With limited technology available to treat the myriad problems of prematurity, nature generally took its course. Most babies born at 28 weeks or earlier were considered late-term miscarriages. Today, an arsenal of sophisticated monitors, respirators, and other technological wonders can keep many of the sickest babies going relentlessly day after day, enabling doctors to save a large

number of premature infants who surely would have died only a decade ago.

But medical technology has proved a mixed blessing. While it often saves babies who turn out to be normal in every way, others who survive carry grievous disabilities throughout life, including severe mental retardation. Their lives are supported at tremendous emotional and financial cost to their families. And technology is some-



times used, as it was with Fleischman's tiny patient in 1993, to prolong the dying process at great expense.

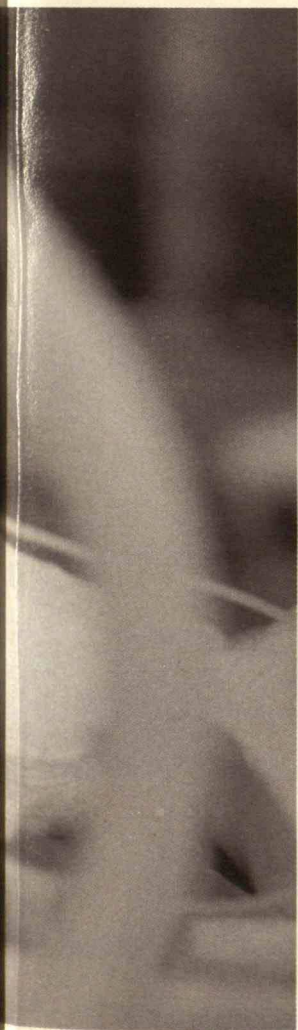
Ethical questions abound—questions for which society has come up with few answers. Is this a reasonable and cost-effective use of technology? Should preemies with the bleakest prognosis be aggressively treated? Who should make that decision—the family, or the physician, or society through the legislative process? And on what basis should the decision be made: Is continuation of life a worthy end in itself no matter how

*STEPHEN D. SOLOMON is a freelance writer and an associate professor of journalism and mass communication at New York University.*



badly disabled the baby will be, or is the quality of that life the primary concern? There is some urgency to these questions, lest the answers be dictated soon by the accountants of health care enforcing ever stricter new economies.

Advances in technology frequently come bundled with difficult ethical questions about their impact on society. But nowhere are such questions posed more



*Birth before  
full gestational age  
brings babies into  
a hostile world  
as an unfinished  
product, like a  
flower bud  
plucked  
too soon.*

dramatically than in neonatal intensive care units, whose rows of incubators hold infants on the cusp of life. In these fragile beings, some so small they would fit into the pocket of a winter coat, reside all of life's potential as well as all of its most frightening possibilities. Here are the weakest and most vulnerable of the human family in a struggle for survival. If there are answers to some of the ethical questions posed by the advance of medical technology, perhaps this is the place to begin looking.

Certainly medical technology has given us much to rejoice over, dramatically improving the survival statistics for premature infants. In 1973, the Supreme Court, in *Roe v. Wade*, set the beginning of the third trimester of pregnancy—about 28 weeks of gestation—as the point at which the states could proscribe abortions. At this point the fetus was “potentially able to live outside the mother’s womb, albeit with artificial aid.” The survival rate in 1973 for babies born at 28 weeks and a weight of 1,000 grams was about 10 percent.

Today only 10 percent die. As many as half of the 24-week-olds survive. In some hospitals today, enormous resources are devoted to saving infants born at 24 or 25 weeks, while on another floor babies of the same age are legally aborted.

Infants born at these early gestational ages face a harsh environment for which they are unprepared. A fetus in utero is a work in progress, with an unforgiving biological clock controlling the development of every major organ system in the body. Birth before full gestational age brings babies into a hostile world as an unfinished product, like a flower bud plucked too soon. Babies born three or four weeks early usually do well without medical intervention because all major organ systems are complete. But before that time, a wide range of problems are possible, and even likely.

Depending on its gestational age, a newborn may be incapable of sucking or swallowing, suffer from kidney failure, or develop circulatory and bowel problems. The immature brain has a delicate vascular system, and many infants born at 23 to 26 weeks develop bleeding in the brain. Often the bleeding is so profuse that it causes extensive neurological damage. One of the biggest killers of premies is respiratory distress syndrome. Before about the thirty-fourth week of gestation, the lungs of a newborn lack enough surfactant, a chemical that enables the baby to easily inflate its lungs.

In the past, an infant’s chance of surviving these and other problems depended on its general endurance as well as its age at birth. Slowly, technology began to intervene. In the late nineteenth and early twentieth centuries, crude incubators for the first time enabled doctors to control the body temperature of premature newborns. To spread the word about this advance, one doctor exhibited the incubators—with premature newborns inside—at fairs throughout Europe and the United States, drawing thousands of gawkers. The



*Lancet*, the British medical journal, feared that hucksters might be drawn to show infants "just as they might . . . marionettes, fat women, or any sort of catch-penny monstrosity."

Treatment was still primitive, says Fleischman, who left clinical practice last year to become senior vice-president of the New York Academy of Medicine. "The first incubators were basically heat sources like the ones used for chickens. There was no monitoring except the nurse walking by. Infection control wasn't a big deal because nobody understood that you could get these kids infected. Apnea wasn't a big deal—if they stopped breathing, they died. Sometimes you'd shake them if you noticed they'd stopped breathing, but you didn't monitor them in any way."

The first half of the twentieth century saw few major advances in the care of premature newborns. They were treated in preemie nurseries, where they were fed and kept warm in incubators. Mortality rates were high: most babies born weighing less than 1,500 grams died from respiratory distress syndrome, infections, and hemorrhages.

But beginning in the 1960s, a series of developments revolutionized neonatal care. Sensitive monitoring equipment enabled medical personnel to continuously measure vital signs such as respiration, heart rate, brain activity, and blood pressure. Mechanical ventilators provided exact levels of oxygen. Resuscitation equipment rescued newborns in distress. Sophisticated incubators precisely controlled the newborn's environment. Infusion pumps administered intravenous fluids. And advanced surgical techniques enabled doctors to correct neurological and other problems that were previously untreatable. Add to those advances a long list of drugs, including a surfactant that enabled many young neonates to breathe on their own and avoid respiratory distress syndrome. By the mid-1970s, many large hospitals had transformed their preemie nurseries into neonatal intensive care units more sophisticated than the ICUs for adults.

These developments appear to have had a major impact on infant mortality rates in the United States. In 1980, 12.6 out of every 1,000 babies died in their first year. By 1992, the infant mortality rate had dropped sharply, to 8.5 per 1,000 babies. This one-third reduction in mortality rates is often attributed largely to advances in drugs and technology for preemies and the opening of hundreds of neonatal intensive care units throughout the country.

The dramatic improvement in survival rates, however, has masked a darker side to neonatal intensive care. Several recent studies show just how sobering the results

can be. One study, published in the *New England Journal of Medicine* on September 22, 1994, tracked 68 children born from 1982 through 1986 with birth weights under 750 grams. Many of the children now suffer visual and hearing disabilities, subnormal growth, mental retardation, cerebral palsy, and poor motor function. Thirty-seven percent have behavioral problems, and 45 percent are in special-education programs. The authors concluded that the low-birth-weight children "are at serious disadvantage in every

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skill required for adequate performance in school."

Another study conducted from 1988 to 1991 at Johns Hopkins Hospital, a leading center for neonatal intensive care, followed 142 infants born at 22 to 25 weeks' gestation and weighing 465 to 975 grams. The infants were tracked for six months. The study, published in the *New England Journal of Medicine* on November 25, 1993, showed that all the babies born at 22 weeks died in the hospital. At 23 weeks, only 15 percent survived, and nearly all of those suffered severe brain bleeds and retinopathy, a disorder of the retina that often leads to partial or total blindness. At 24 weeks, 56 percent of the



infants survived, but only 26 percent of the survivors avoided brain bleeds; more than half suffered retinopathy. At 25 weeks, 79 percent survived, 68 percent of them without brain bleeds. About one-third suffered retinopathy.

Tending to these infants is costly. About 300,000 babies are treated each year in the neonatal intensive care units of some 600 U.S. hospitals. (Most of them are preterm babies, but some full-term babies require special care as well.) Ciaran S. Phibbs, a research

24 weeks of gestation, how much weight should the possibility of a good outcome carry?" Should viability be defined in terms of gestational age and birth weight measurements, below which a premature newborn would not be aggressively treated? Or should other factors be considered in the decision whether to treat, such as the parents' desires and their history of fertility, or the method of payment?

"Concern for limited health care resources," they concluded, "necessitates opening discussions about who should receive intensive care and how these decisions should be made." After several decades of accelerating technology in the care of premature newborns, it was time for ethical considerations to catch up.

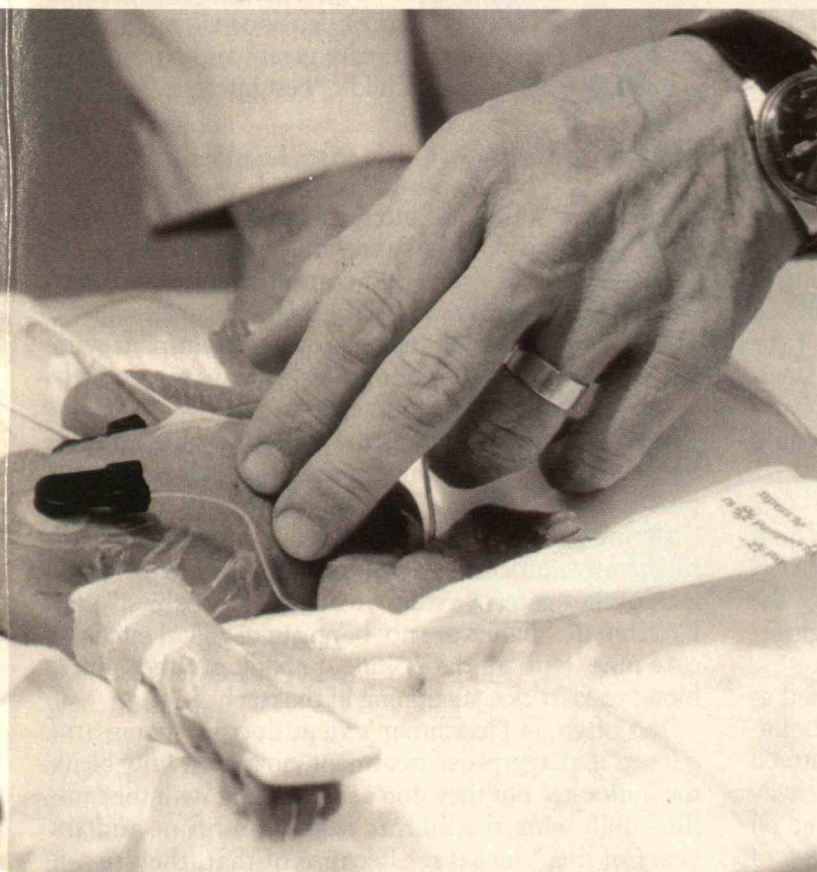
### The Struggle for Consensus

In the years before technology took over the neonatal units, doctors themselves often decided not to resuscitate a premature infant, or one born with serious birth defects. "If you look at the literature from the 1920s and 1930s on children with spina bifida, it's written that they were all stillborn," says Fleischman. "We know they *weren't* all stillborn."

In 1973, two pediatricians at the Yale-New Haven Hospital made public what had until then been an open secret in delivery rooms throughout the country. In an article published in the *New England Journal of Medicine*, Raymond S. Duff and A.G.M. Campbell revealed that 43 infant deaths in the hospital's intensive care nursery from 1970 to 1972 had resulted from the intentional withdrawal of treatment. In all 43 cases, they wrote, doctors and parents had "concluded that prognosis for meaningful life was extremely poor or hopeless, and therefore rejected further treatment.

The awesome finality of these decisions, combined with a potential for error in prognosis, made the choice agonizing for families and health professionals."

Were parents and doctors entitled to make such judgments, pushing aside technology that could have prolonged the lives of these babies? The issue was not really joined until 1982, when two parents in Bloomington, Ind., allowed their infant, who came to be known as Baby Doe, to die. The parents refused consent for treatment of Baby Doe, who had been born with several serious medical conditions, and their decision was upheld by a local judge. Even nourish-



economist at the Veterans Affairs Medical Center at Stanford University School of Medicine, has pegged the average cost of care for all babies (including preemies) born and discharged home to be \$2,695 in 1990 dollars. But for preterm babies with birth weights of 500 to 749 grams—born at about 24 to 27 weeks—the cost was \$119,339 each.

Given the high cost of ministering to the smallest infants—and given the dismal outcomes—the Johns Hopkins researchers, led by Marilee C. Allen, asked whether all such babies should be treated. "In decisions about aggressive resuscitation for infants born at 23 or



ment was withheld, and the infant died six days later.

The drama of Baby Doe's death, covered extensively by the press, caused a national furor. The Reagan administration immediately promulgated what became known as the "Baby Doe regulations," which required hospitals receiving federal funds to post signs stating that failure to feed and care for handicapped infants was prohibited by federal law. The government set up a toll-free hotline for people to report any such incidents. The federal courts, however, twice struck down the Baby Doe regulations on a number of legal grounds—for example, that they were imposed without the 60-day comment period required for federal regulations and were "arbitrary and capricious."

In response, Congress passed the Child Abuse Amendments of 1984, which made the withholding of medically indicated treatment from a disabled newborn with a life-threatening illness a form of child abuse. Federal regulations under the law listed three exemptions. The first covers infants who are "chronically and irreversibly comatose." The second applies when treatment "would merely prolong dying, not be effective in ameliorating or correcting all of the infant's life-threatening conditions, or otherwise be futile in terms of the survival of the infant. . . ." The third exception applies where treatment has but a slim chance of saving the infant "and the treatment itself under such circumstances would be inhumane."

"Baby Doe scared the hell out of the profession," says Fleischman. "The idea was that now you've got to treat everybody all the time, even if there's a kid that's suffering. By the '80s you also had hotshots pushing the thresholds of the new technology. You got an aggressive consensus to treat."

That consensus eroded as the decade wore on and as it became evident that terms such as "futile" and "inhumane" in the Child Abuse Amendments contained enough play to give doctors broad discretion in the way they treated premies. If doctors and parents agreed on a course of treatment that involved a liberal reading of the regulations, who was there to complain? "It took until about 1990 to bring that pendulum back to about a middle ground," Fleischman says.

In the 1990s, middle ground means making decisions case by case. But a consensus on how to evaluate individual cases is difficult to find, and two babies with the same condition, placed in the hands of different doctors and a different set of parents at a different medical center, may not be treated with equal aggressiveness. There is broad disagreement over how to value the future life of a preemie who might be saved, but saved to a future of severe handicaps—or whether quality-of-life considerations should come into play at all.

The ethical questions about nontreatment are difficult enough concerning adults facing end-of-life decisions.

Adults can refuse sophisticated technology that merely prolongs a terminal condition, and many doctors encourage people to sign living wills that set out their wishes about extraordinary treatment in the event that they become so sick that they are unable to communicate. In cases where an adult is incompetent and there is no living will, the law will often accept a close family member's "substituted judgment," or evidence of what the patient would have chosen had he or she been awake and competent.

The problem, though, is considerably more complicated in the case of premature infants. Because a baby has never had any period of competence in which to indicate desires and preferences, decision making revolves around an alternative test: care givers and parents are supposed to consider the child's "best interests."

### Ethical Crosscurrents

But what is in the best interests of a particular infant often is impossible to answer with certainty. Some doctors and ethicists argue that continued life is virtually always in the best interests of the infant, regardless of the quality of that life. In its bias toward treatment with few exceptions, this position probably hews most closely to the Child Abuse Amendments.

Such a position elevates the sanctity of life and the moral necessity of fighting for the most vulnerable and powerless of human beings. But it tends to ignore the suffering endured by very sick babies, made worse by the invasive procedures required for treatment. "With a lot of the aggressive stuff we do, we hurt babies," says Fleischman. "Babies are not happy in neonatal intensive care units with all the poking, prodding, tubes, lines, blood tests, sticks, suctioning in the trachea."

Too often, in Fleischman's view, doctors strong-arm parents into aggressive treatment, no matter how bleak the outlook. "But they don't suffer along with the families, following the infants to two and four and six years of life," he says. "Because of that, they're not sensitive to the pain that the kids and their families go through. They arrogantly believe that because they can provide therapy and technology, they should or must provide therapy and technology—that there's a technological imperative."

A tempting alternative is to let the parents be the judge in cases where the best interests of their child are unclear. After all, it is they who are the legal guardians, and they who must provide consent for treatment. But leaving the decision to the parents has serious shortcomings as well. For one, doctors do not always provide parents with reliable information. "We can predict the outcome in the worst cases," says Fleischman. "If I see a baby who is 600 to 700 grams, who's moribund on the ventilator, not moving around, having seizures,



with a big bleed in his head, I can tell that family that that child is in serious trouble. Yet there are some doctors who would say to the family, 'I'm not certain. There's been a case I've read about,' or 'I've seen a child who's survived.' That's the most dangerous doctor."

Relying on parental wishes also confers on parents enormous power to end a baby's life for reasons that may be purely personal. In a sense, the parents have a conflict of interest, since the survival of a child who may never be able to care for itself obviously restricts the parents' freedom.

On the other hand, parents sometimes demand treatment even when the prognosis is bleak. "If that baby were suffering and the benefits of treatment were marginal, I would have a moral obligation to override that parental request for treatment," says Fleischman. "I would argue that she was suffering so severely that it was in her interest to be dead. That's heavy. But I have the right to make that argument if she were suffering." (To act on that argument, however, would require a court order.)

The infant's pain aside, parental choice to continue treatment in the face of devastating long-term complications may be something the nation cannot afford much longer. "Society has to decide what resources to put into little babies who are going to die in six weeks and cost \$250,000, because if they die now they cost a lot less," says Fleischman. In a world of finite dollars, resources expended in saving grievously sick neonates may not be available for prenatal care and for babies in other kinds of trouble.

Admitting quality-of-life issues into the "best interests" calculus can sometimes clarify decision making. It

forces parents and care givers to face the question: What is the potential for a meaningful life in terms that are distinctly human—the ability to think, to love, to form human relationships? Perhaps a life stripped of these attributes has little about it that we regard as human.

If there is little likelihood of cognitive development, many parents would rather opt out of aggressive treatment.

But one of the dangers of a quality-of-life assessment is that it is difficult for doctors and parents to apply consistently. How one regards the future life of an impaired newborn may depend on the parents' socioeconomic status, religious beliefs, educational level, and expectations for their children. For example, some hard-driving professionals may be disappointed with a child too impaired to compete in life at their level, and so might be more likely to give up on the child and try again. And even under the best of circumstances, life-and-death decisions concerning a tiny, fragile human being are so emotionally charged that they strain the ability to reason.

In the case of baby Jennifer, who spent two months at Fleischman's neonatal unit, such an overlay of emotional conflict only deepened the problem of reaching a consensus. Fleisch-

man recalled the Jennifer Brown case in an essay published in *Ethics at the Bedside* (edited by Charles Culver, University Press of New England, 1990). Susan Brown arrived at Weiler Hospital in the Bronx in the twenty-fifth or twenty-sixth week of her pregnancy. She delivered a daughter weighing 830 grams. On admission to the neonatal intensive care unit, of which Fleischman



*Fleischman often  
circles back to his medical-school days,  
when he wanted to save a 28-week  
baby but there was no  
technology to do it.*



was the director, the baby was in critical condition and her prognosis was poor.

Jennifer's condition deteriorated on the second day of her life. High pressure from her respirator caused her lung tissue to tear, and air escaped into her chest cavity. Then she developed kidney problems, and ultrasound examination revealed substantial brain bleeding. Another ultrasound at one week of age showed that the blood had destroyed some brain tissue.

By now it was clear that the baby would have serious neurological impairment and cognitive dysfunction, and that there was virtually no chance of a normal outcome. But the attending physician had developed a personal relationship with Brown, a single woman without children who desperately wanted a baby. So she conveyed the prognosis to Brown in more optimistic terms than were warranted.

Over the next several weeks, the baby's condition steadily worsened. Yet the emotional bonds that grew between the medical staff and Jennifer's mother made it difficult to communicate the baby's bleak prognosis. Even as the infant's chances of survival slipped toward zero, the mother insisted on aggressive treatment and the staff acquiesced. Finally, after eight agonizing weeks, Jennifer's heart gave out and she was allowed to die peacefully.

The moral of Jennifer Brown's case, and of all too many similar cases, says Fleischman, is that the care providers loved not wisely but too well. "You get involved in the family's wishes, particularly a woman like Ms. Brown, who was just a lovely lady, who cared so much about her child and accepted disability. The doctors got into that with her, wanting to give her a child. If they didn't, they were failing. They didn't want to fail her and they didn't want to fail the child. So this was a very sad case, and it took a long time. And we suffered with her."

### Deliberation Deferred

Because it is difficult to make rational decisions in the emotional cauldron of a neonatal nursery, some ethicists push for a more categorical approach. Aggressive treatment would be withheld for preemies who had certain conditions that were spelled out in advance—conditions so hopeless and so painful that death itself

would be in the best interests of the infant. These babies would receive care for basic needs and for relief of pain, but no heroic efforts would be made to save them.

This line of ethical reasoning proceeds from the idea that most of us, if we thought about the worst things that could happen to us, would probably list at least a few conditions that would constitute a fate worse than death. If adults might prefer death to some terrible condition, perhaps the same can be assumed of preemies.

Perhaps the least controversial category of such cases would be those in which death is imminent and the use of technology would merely prolong the dying. In principle, the Child Abuse Amendments already grant physicians the power to pull the plug under these circumstances. The categorical approach would merely add specificity to the vague and impressionistic language (like "futile" and "inhumane") with which that power is now defined. Treatment would be withheld, for example, from babies born at a certain gestational age and weight at which mortality is virtually 100 percent within a certain period of time—say, six months.

One of the strengths of this approach is that it homes in on the best interests of the individual newborn, not on the wishes of parents, families, doctors, or society. In that sense, say proponents like Fleischman, it keeps

the discussion focused squarely where it should be, on the child. And if certain conditions that will not be aggressively treated are specified in advance, similar cases will tend to be handled alike.

But it would surely be difficult to reach agreement on all such conditions. Under the pressure of reducing health care costs a few years ago, Oregon moved quickly—perhaps too quickly, as it turned out—to implement a decision-making plan such as this one. The state extended Medicaid coverage to a large number of the working poor, but in order to live within an affordable budget, it eliminated Medicaid reimbursement for scores of conditions and treatments based on their cost and effectiveness. Among the reimbursements the state proposed to cut were those for infants born at less than 23 weeks' gestation and 500 grams.

Ultimately, however, the state was unable to defend the medical criteria behind the category it had created—criteria based partly on such weak evidence as telephone surveys. The federal government refused to approve the change on preemies, concerned that such

*A philosophy  
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ment from preemies  
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or doctors.*



a cutoff would violate the Child Abuse Amendments; the cutoff was based largely on quality-of-life considerations, which the amendments do not sanction. The government also foresaw violations of the Americans with Disabilities Act, which prohibits discrimination based on disabilities.

If there is a way to resolve some of these questions, it may eventually come from the growing body of research on early preemies. A number of studies at hospitals around the country are following the progress of premature babies, measuring physical and cognitive development even as the children reach school age. As more results become available, it may be possible to pinpoint with some accuracy the combination of birth weights, gestational ages, and conditions that inevitably produce severe impairment or death. These may contribute to a consensus on which conditions are not successfully treated regardless of the resources committed to the battle.

Meanwhile, the immediate prospects appear dim for resolving the ethical problems in neonatal nurseries. The rush of technology has left serious gaps in law and ethics in many areas of modern life, and these gaps are rarely

filled quickly. The neonatal dilemmas could hardly be more tangled and more difficult, given that they concern life-and-death decisions regarding those at the beginning of life, too young to speak for themselves and too human and fragile to be abandoned easily. Perhaps only a financial crisis that finally brings legislators, insurers, doctors, and ethicists to the table will force society to decide what sort of treatment it deems acceptable and hence what it is prepared to pay for.

Rationing care, of course, was not an issue just a few decades ago. Fleischman circles back many times to his experience as a fourth-year medical student, treating a 28-week baby with a hand ventilator all night long as he waited for his professor to arrive. He wanted to save that baby, but there was no technology available to do it.

Today, thanks to the arrival of new machines and medicines, most 28-weekers do well. But by extending the horizon, technology brings its own problems—agonizing decisions that did not have to be made a generation ago. Although neonatologists have sophisticated new options, perhaps there are times when it is best to turn them aside and let nature have its way. ■

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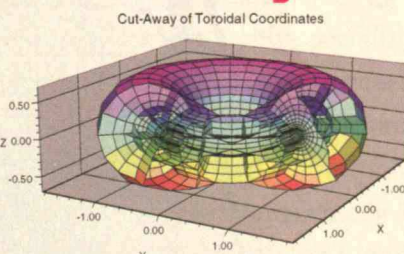


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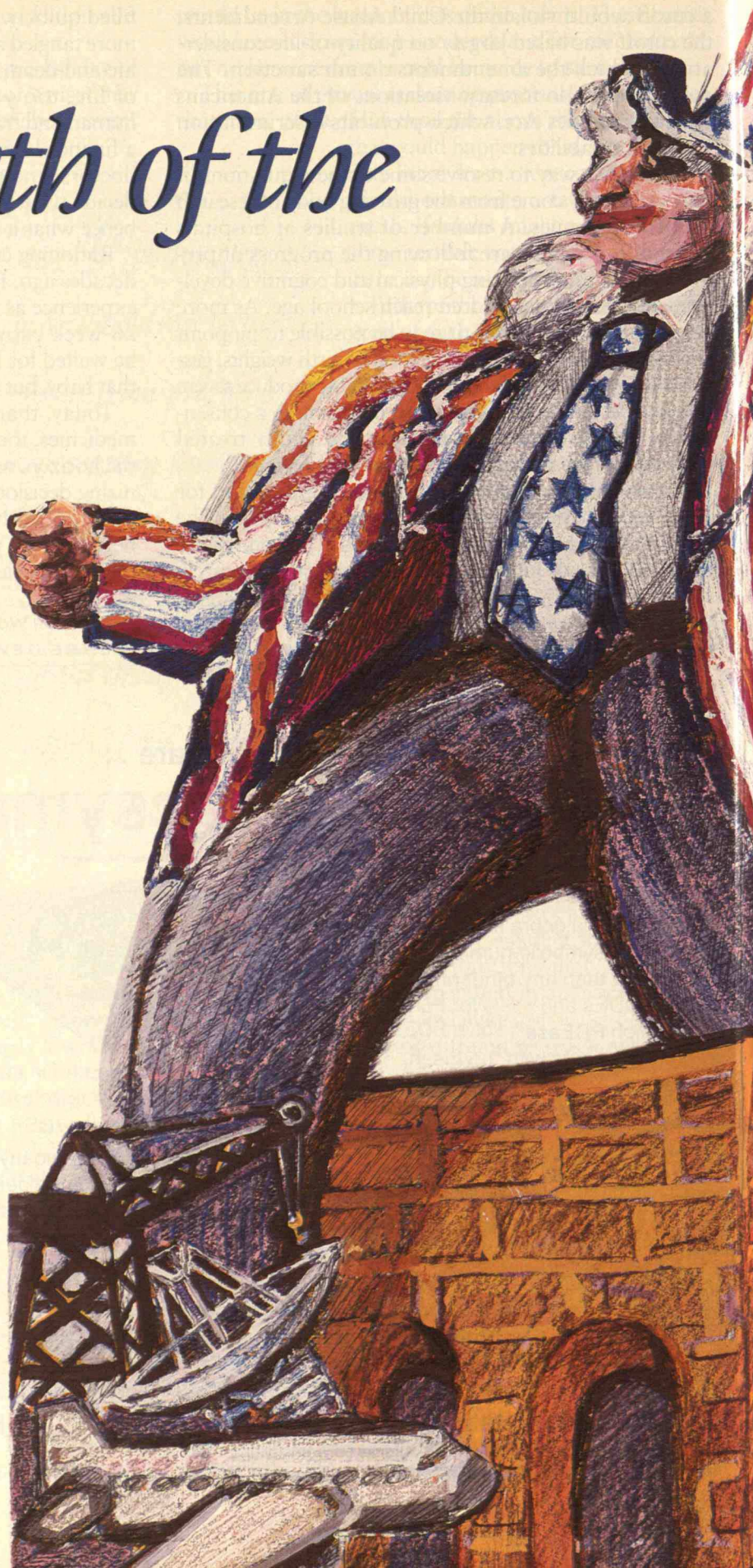


# The Myth of the

BY MARYELLEN R. KELLEY  
AND TODD A. WATKINS

*Contrary to the beliefs of analysts from both the right and the left, U.S. manufacturers already combine production for military and civilian markets.*

*Would-be designers of industrial policy can readily build on this situation for the post-Cold War era.*







# *Specialized Military Contractor*

**M**OST people think of companies that manufacture the world's most advanced military machines as inhabiting a separate industry highly dependent on the Pentagon. To both critics who want to shrink the defense budget and supporters who want to raise it, wholesale conversion of such firms to serve nonmilitary customers seems fanciful at best. Even the more modest goal of integrating commercial and military manufacturing looks formidable. ⚙ But our research indicates that the image of a few highly specialized defense contractors occupying an enclave walled off from commercial manufacturing is largely a myth. In extensive interviews with managers in the "machining-intensive durable goods" (MDG) sector, which accounts for half of all durable goods purchased for defense in 1990 and about one-fourth of all U.S. manufacturing output, we found that the vast majority of defense contractors serve both military and civilian customers. What's more, strengths developed under the umbrella of national security are being tapped to benefit firms' commercial work, and vice versa. This is true among not only the major contractors that serve the Pentagon but the thousands of subcontractors that actually perform a substantial share of military manufacturing. ⚙ This outcome stems partly from the fact that in the industries we studied, many of the features thought to be peculiar to the defense contracting relationship—low volumes, custom orders, a high degree of dependence on a few customers, and a small number of rivals—apply just as strongly to commercial work. A manufacturer custom-builds a new conveyor system



for the United Parcel Service or a massive, high-speed paper-cutting machine for a daily newspaper, for example. And managers in the MDG sector reported reaping an average of 60 percent of their revenues from their three largest customers, while some 50 percent cited six or fewer potential or actual competitors, whether or not their companies performed defense work.

Our findings suggest that fears of a defense industrial base jeopardized by the decline in U.S. military spending—from a post-World War II peak of 6.5 percent of GDP in 1986 to 3.5 percent by 1997—are overblown: strong links between military and civilian manufacturing mean that most firms in this sector will remain capable of supplying the needs of the Department of Defense (DOD) in the coming decade. But our revisionist view does suggest that the kinds of benefits the United States has reaped from its defense industrial policy will require counterparts in various civilian-based initiatives if such strengths are to be maintained.

### What Wall of Separation?

In *Beyond Spinoff*, John Alic of the congressional Office of Technology Assessment and Harvey Brooks, Lewis Branscomb, and Ashton Carter of Harvard's Kennedy School of Government report that the 67 largest publicly traded prime contractors—the major firms responsible for producing military airplanes, tanks, missiles, submarines, and weapons—derived only 9 percent of their total revenues from military work during the peak years of the 1980s buildup. Only a handful of those

firms truly specialized in defense work, gaining at least 50 percent of their income from DOD. Today even large defense companies such as Rockwell and TRW take in only about a third of their income from the Pentagon.



*Major defense contractors rely  
on a network of thousands of subcontractors  
that includes a significant percentage of all  
U.S. manufacturing companies.*

Far from responsible for most of the nation's military manufacturing, these major defense contractors stand at the top of diverse and deep supply structures. AlliedSignal, consistently among the top 25 prime contractors, depended upon materials and components from 7,500 to 10,000 suppliers who accounted for 60 percent of its defense contract costs in 1993, for example. Similarly, some 60 percent of the dollar value of Pratt & Whitney's military aircraft engines goes to suppliers. To build the inertial guidance system for the MX missile, Northrop relied on more than 500 subcontractors to make 19,000 parts. And at Lockheed/Fort Worth, subcontracts consume 75 percent of the cost of making the F-16 aircraft.

This supplier base encompasses a significant percentage of all U.S. manufacturing companies. In a 1991 survey of firms in 21 durable goods industries, as well as an analysis of 1988 data gathered by the Census Bureau, we found that fully half of all plants make parts, components, or materials for military equipment. Fewer than 1 in 10 prime contractors and their suppliers in this sector depended on DOD for more than 80 percent of their output in 1990. Clearly a vast number of companies perform both defense and civilian work.

Still, high-profile cases such as Lockheed's Skunk Works, incubator for the U-2 and SR-71 "Blackbird" spy planes and more recently the F117A Stealth fighter, and Maine's Bath Iron Works, which builds Navy destroyers, have helped solidify the view that whatever the overall importance of defense contracts to their total business, companies almost always perform military work in facilities dedicated to defense. But our 1991 sur-

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vey revealed that most companies in the MDG sector in fact make commercial and defense products on the same machinery with the same people.

For example, General Electric has been among the top 10 defense contractors for more than 35 years. But at GE Aircraft Engines, which derives more than half its revenues from civilian sales, commercial and military production share management, R&D facilities, and manufacturing workstations. In a joint venture with the French firm Snecma, the company produces CFM56-2 jet engines, the technical core of which powers the B-1 bomber, for DC-8 commercial airplanes as well as the Air Force's KC-135R tanker aircraft. Hewlett-Packard's Microwave Semiconductor Division and major producers of satellites such as Hughes integrate military and civilian production, while Pratt & Whitney sells the PW-2037 engine for both commercial and military use.

Examples among medium-to-large firms that supply these prime contractors abound, especially those serving the aerospace industry. The Lord Corp., a leading supplier of rubber-to-metal adhesives and computerized vibration-control equipment, uses a single division and the same engineering group to work on the Boeing 737, 757, and 767 aircraft as well as the Black Hawk helicopter and the Osprey tilt-wing transport. The Casting and Forgings Division of Wyman Gordon Co. employs the same people, processes, and equipment in supplying special alloy castings to GE Aircraft Engines, Pratt & Whitney, Boeing, and McDonnell Douglas. Menasco, one of the world's leading suppliers of landing gear, makes equipment for the military's Apache helicopter in the same plant where it produces titanium parts for the new Boeing 777. And at Vought Aircraft, fabrication and assembly of the wing for the Gulfstream V corporate jet occurs in the same facility as work on the C-17 military transport.

Our visits to smaller subsystem and component manufacturers also revealed completely integrated facilities. Electroid, a specialty manufacturer, produces high-per-

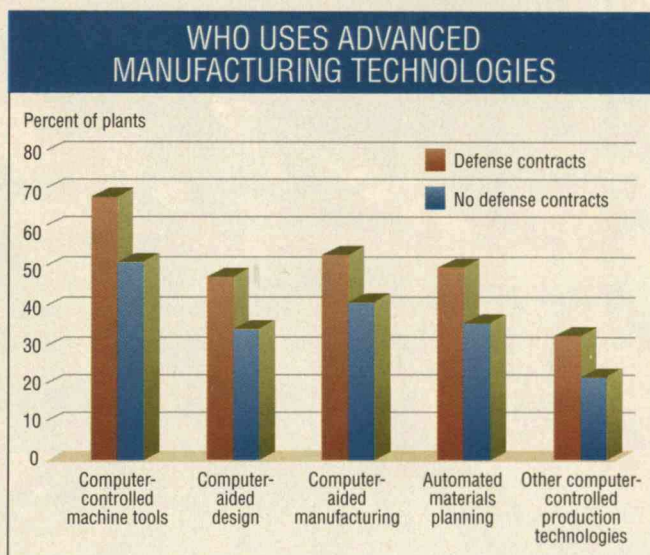
formance equipment that engages or disengages mechanical power, or stops and locks moving parts, in packaging machinery, photocopiers, industrial robots, the Apache helicopter, and the turret on the M1 tank. Electroid's fail-safe brakes also latch bay doors in position on NASA's space shuttle. The company's

major customers include AlliedSignal, Boeing, General Electric, Goodyear Aerospace, McDonnell Douglas, Scientific Atlanta, and Westinghouse. According to a division president, the company has purposely prevented its military business from exceeding 20 percent of annual revenues since it began doing defense work in 1981.

A division of Valcor Engineering, Electroid has been in business for 35 years, 17 in its present manufacturing facility, which employs 100 people. This facility dedicates no equipment or employees to military production: a worker might spend one hour on a military job and the next hour on a product for an industrial robot. Engineers, too, design products for both commercial and mili-

tary customers. The only feature unique to military goods identifies all production for the stringent "nuclear, aerospace, and military" sector: NAM work is placed in blue plastic tote bins while pieces for non-NAM customers go in tan-colored bins. This color coding alerts employees to follow specific written instructions at each workstation, since inspection procedures as well as designs, materials, and tolerances must be checked at each stage for NAM customers, whether civilian or military.

Tecknit, another small company that supplies military contractors, makes an array of products for shielding electrical equipment from electromagnetic-radiation interference. These products include conductive elastic polymers (similar to rubber), adhesives, paints, and greases, as well as shielding screens, coated windows, and air-vent panels. At the height of the 1980s defense buildup, the firm's U.S. operations depended on military contracts for more than 70 percent of sales, but this share shrank to 50 percent by 1993.



*Firms that make durable goods for both military and civilian use are significantly more likely than their strictly commercial counterparts to employ cutting-edge manufacturing technologies. The reason: the Department of Defense supports the development of these technologies and encourages large and small firms to work together to adopt them.*





Focusing on a core technical area enables the company to serve a wide variety of customers: its largest include major defense contractors such as Westinghouse, Rockwell, Raytheon, Boeing, Hughes, and Martin Marietta, as well as AT&T and computer companies such as Apple, DEC, Dell, and IBM. Production is low-volume and labor-intensive—much of the assembly work is still done by hand. At this company no special labeling distinguishes defense products from commercial goods: the technology, manufacturing equipment, process flow, labor, and engineering are identical. The only differences occur in the more stringent documentation required by DOD of the final inspection and testing.

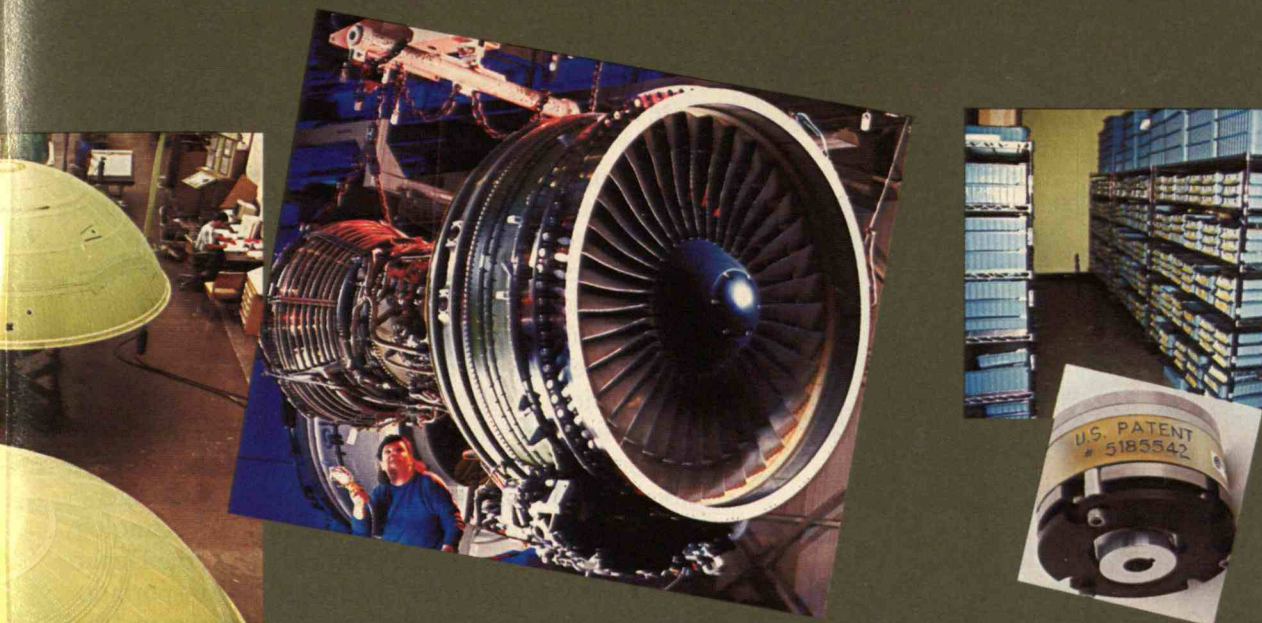
Delroyd Worm Gear, manufacturer of standard and customized products for both military and civilian markets, makes large speed-reducing gears for conveyors, printing presses, oil drilling pumps, and cranes, as well as canal locks (including some used in the Panama Canal) and aircraft-hangar doors. The company depends on the Pentagon, specifically the Navy, for only 5 to 10 percent of overall sales. At the plant we visited, which employs fewer than 100 people, the company does not distinguish its work for the Navy in any way, including during testing and inspection—the military simply places an order identifying the part it wants Delroyd to build. In the past, orders for replacement parts

usually had to match the specifications on the original order, meaning that the Navy sometimes bought gears made with older, and thus inferior and more expensive, materials. But recent procurement reforms have made it easier to change the specifications on purchase orders, thus allowing the Navy to take advantage of new commercially available technologies and materials.

### The Advantages of Defense Contracting

Overall we saw little evidence that manufacturers in the MDG sector see defense work as a contaminating drag on their civilian work. Indeed, we found that firms in the defense contracting network are actually better prepared than their strictly commercial counterparts for the collaborative relationships often credited with providing a competitive advantage. That's because support for interfirm learning is particularly strong among companies that do defense work. More than 60 percent of the defense contractors in our survey provided technical assistance to their subcontractors, compared with fewer than 44 percent of strictly commercial manufacturers. Military contractors in the MDG sector are also more likely to collaborate with subcontractors in developing new products and to provide financial aid. One manager told us his company became a defense





*"Dual-use" manufacturing can take a number of forms. Pratt & Whitney sells the PW2037 engine (above) for both military and civilian aircraft. Similarly, the GE engine that powers the KC-135R Air Force tanker (far left) also runs DC-8 commercial planes. At Vought Aircraft Co. (second from left), the same employees design, fabricate, and assem-*

*ble subsections for use by military and commercial customers. Few firms give special treatment to defense products. At Electroid Co., workers store parts such as this brake for the B-1 bomber (above right) in blue bins denoting the stringent inspections required by all customers in the exacting NAM (nuclear, aerospace, and military) sector.*

subcontractor specifically to take advantage of the technical assistance the prime contractors provide in setting up new quality-control systems. Another manager attested that because companies often have access to advanced technology, "being involved in defense work... keeps your engineers sharp."

In fact, firms that do defense work are way ahead of the curve in applying information technology to manufacturing. By 1991, about two-thirds of the plants with defense contracts we surveyed used programmable machine tools, compared with less than half of the strictly commercial plants. (We estimate that such tools reduce production time per unit of output by an average of 30 percent.) Firms with defense work invested 31 percent more per employee and tended to adopt newer technology. We also found that defense contractors have been more innovative in applying computer-aided design, computer-aided manufacturing, and computerized quality control.

Government initiatives directed at the defense industrial base are at least partly responsible for these significant results. DOD supported the development of advanced technologies and process techniques through its ManTech program during the 1980s, for example. The program disbursed \$150-\$200 million annually throughout the decade, exceeding all state spending on

technical assistance during that period. Although ManTech aided a relatively small number of contractors, DOD sponsored annual conferences and workshops to highlight the lessons that early adopters of new manufacturing technologies had learned.

The Department of Defense also financed technical assistance to subcontractors from 1982 to 1992 through its Industrial Modernization and Incentives Program. The aircraft industry was a major beneficiary—all large prime contractors had their own IMIP, and hundreds of subcontractors benefited. The most extensive effort, run by General Dynamics for F16 subcontractors, provided technical assistance to more than 60 firms involved in 200 projects.

### Toward New Collaborations

Whether or not the few extremely defense-specialized large contractors are able to survive the downsizing of Cold War-driven demand, the large majority of companies in the military production network clearly are already poised to make the adjustment. Not only have most been using the same workers and equipment to make military and commercial products for years, but even companies highly dependent on defense contracts during the 1980s have diversified their customer base.





*Continued federal support for collaborations aimed at developing and diffusing new technologies and enhancing the abilities of supplier firms is essential as the defense budget declines.*

Yet if the problems these firms face have almost nothing to do with their fitness to serve commercial markets, our findings do suggest the need to continue federal support for interfirm collaborations aimed at developing and diffusing new technologies and enhancing the abilities of supplier firms, on which the production of major items like automobiles, aircraft, machine tools, and computers depends. The need is especially great given that large firms are demanding that suppliers invest in new technologies and quality control while also cutting prices. Unfortunately, lead companies are much less likely to accompany demands on suppliers outside the defense network with technical aid or funding. Without systemwide support for new technologies and revamped management and shop-floor organizations to support them, suppliers' efforts to cut costs are likely to undermine their long-term viability.

Partly to meet this need, programs such as the Clinton administration's Technology Reinvestment Project (TRP) explicitly support the kind of industrial networks we have found among defense contractors (the average TRP-funded program includes 7.5 organizations) and encourage their extension to new commercial ventures. Although established under the auspices of DOD, TRP aims to stimulate both commercial and military strengths in 11 high-priority areas, including information infrastructure, design and manufacture of advanced electronics, vehicle technology, and health

care and environment. Dedicated to speedy proposal review (the program received 2,763 applications in 1993) and requiring virtually no new bureaucracy, TRP's three-pronged approach includes bringing together consortia of companies and universities to develop, demonstrate, and apply dual-use technologies; helping small companies improve their use of advanced manufacturing technology; and enhancing individuals' dual-use engineering and technical skills, especially among those displaced by defense cutbacks. TRP also emphasizes interagency cooperation: the president's National Economic Council coordinates the participation of DOD's Advanced Research Projects Agency, the National Institutes of Standards and Technology, the National Science Foundation, NASA, the Department of Energy, and the Department of Transportation. TRP will award \$1.5 billion for 212 projects in 1994-95, with the government contributing 40 percent of the overall costs and other groups, including states and nonprofit organizations as well as industry participants, providing the rest.

The National Institute of Standards and Technology's Manufacturing Extension Partnership Program (MEP) has the potential to serve civilian needs even more directly. For example, an MEP center in Michigan provides a forum where companies making autos and office equipment can learn about suppliers' problems, while a center in Minnesota is helping large firms develop common standards for their subcontractors. The federal government now funds this \$90 million program, but states and the private sector are supposed to pick up the tab within a few years. Taxing industry members would be one way, with precedent in sectors such as apparel, to ensure long-term funding for these centers.

To build on such efforts, the bipartisan 41-member Manufacturing Task Force in the U.S. House of Representatives recently proposed a broad package aimed at diffusing new technology, largely to small and mid-sized businesses. Besides expanding the Manufacturing Extension Partnership Program, the task force recommends that the Department of Commerce develop teaching factories and fund state pilot programs to help firms evaluate their technology and training needs.

Institutions that encourage collaborative design, development, and problem solving among large companies, suppliers, and third parties such as government agencies already define the state of the art in European and East Asian industrial policy. In the wake of the Cold War, the United States actually possesses most of the critical ingredients for pursuing these best practices. All that remains is to shed our ill-informed fears that U.S. defense contractors are so isolated from market forces that they are not up to the job, and forgo our ideological opposition to the idea of government and business actively working together to strengthen the commercial industrial base. ■



I N T E R V I E W

# I.M. PEI

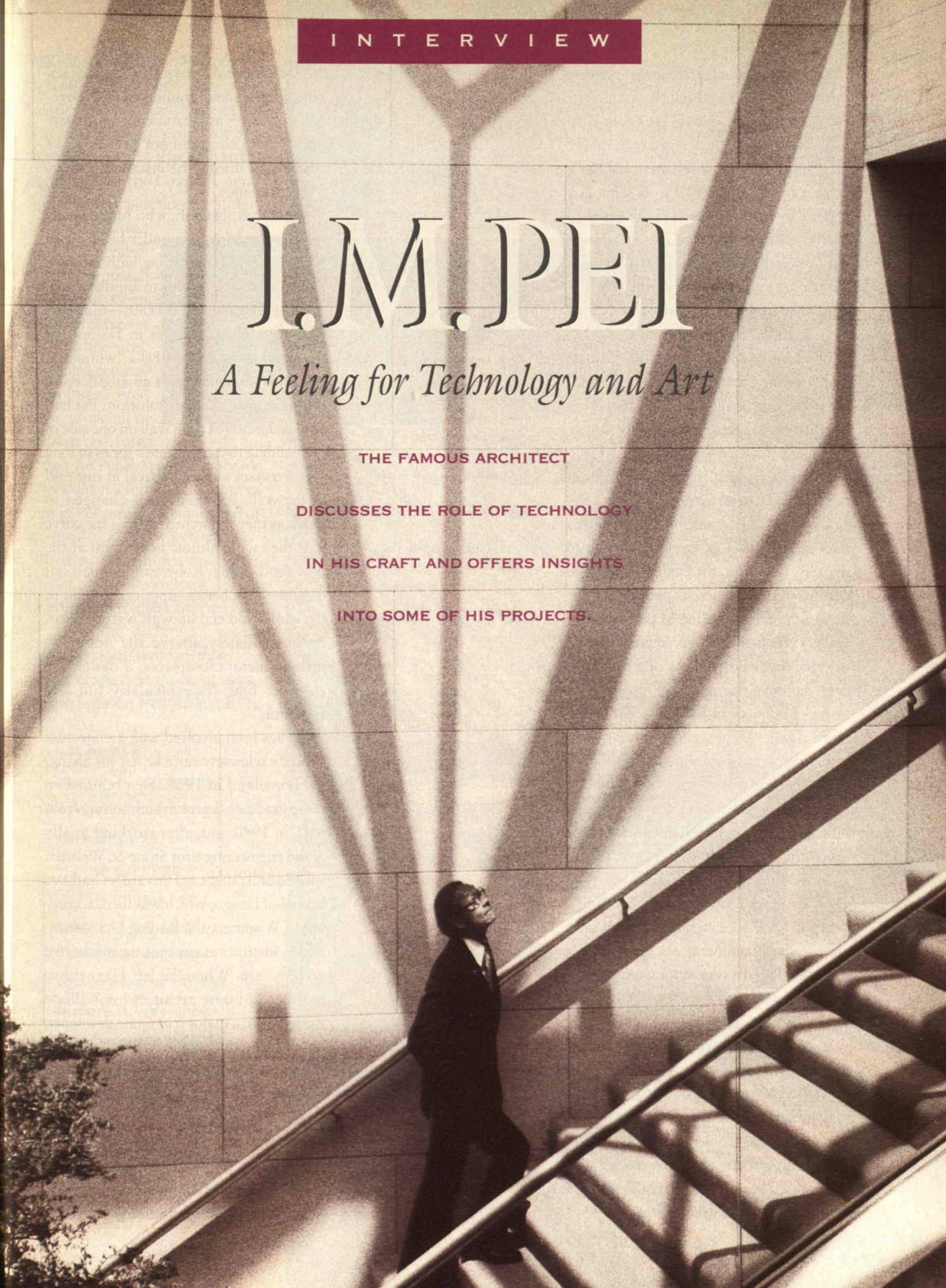
*A Feeling for Technology and Art*

THE FAMOUS ARCHITECT

DISCUSSES THE ROLE OF TECHNOLOGY

IN HIS CRAFT AND OFFERS INSIGHTS

INTO SOME OF HIS PROJECTS.






**A**LTHOUGH all architectural projects must necessarily take both technical and artistic matters into account, top architects in major firms usually rely on others to handle a project's particulars. Not Ieoh Ming Pei, better known as I.M. Pei. In both the engineering and artistic realms Pei is "always nuts about details," says Carter Wiseman, author of a 1990 biography on the renowned architect, whose commissions have included the massive renovation of Paris's Louvre Museum and the geometrically striking designs for the East Building of the National Gallery of Art and the Morton H. Meyerson Symphony Center in Dallas.

Pei's enthusiasm for design details is reflected in the attention his firm, Pei Cobb Freed & Partners, pays to problems and extends even to seemingly minute matters. Consider, for example, how the company approached its commission to design the East Building of the National Gallery. Pei first came up with the idea of interlocking two sections of a building, each having a triangular footprint, on a trapezoidal piece of land adjacent to the original gallery. The architects then saw to it that the wood forms used to pour concrete members were "made with the same care as if they had been pieces of fine furniture," Wiseman notes, discarding them when they could no longer provide the specified finish. And recognizing that the slabs of marble on the East Building's "curtain wall," or exterior surface, would change size as temperatures altered, Pei's team developed a system for hanging each stone independently, to allow for every piece's expansion and contraction.

In a recent interview, Wiseman said that Jean Lebrat, the president of the public authority responsible for the Louvre's renovation, maintained that "he was used to cleaning up problems after architects who don't understand engineering," yet such efforts weren't necessary for the Pei team. For example, the thoroughness of



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the architectural drawings and specifications for the metal-frame and glass pyramid that serves as the museum's entryway meant that Lebrat did not have to make corrections during the installation of its 698 glass panes.

Leslie E. Robertson, who runs a structural-engineering firm under his name in New York and is working with Pei on a project in Jakarta, points to another structure Pei designed in the 1980s—the Meyerson Symphony Center in Dallas—to exemplify what he calls Pei's "wonderful gift": his ability to turn an engineering problem into a design solution. Pei had designed a curved glass wall on one side of the building to incorporate a series of long metal trusses almost vertical at one end of the wall. But their angle changed so much as they "marched" across the curve that they were almost horizontal at the other end. When Robertson pointed out that, without better support, this end of the wall could end up with warped glass, Pei immediately altered the design to include metal crosspieces, a design the engineer finds "spectacularly fun and beautiful."

Pei has been involved with architecture almost exclusively since he left his Shanghai homeland in 1935. He obtained an undergraduate degree in architecture from MIT in 1940 and, after working briefly at the engineering firm Stone & Webster, studied and taught at Harvard's Graduate School of Design, which was then, according to Wiseman, the leading U.S. educational institution promoting modernist architecture. When Pei left Harvard to work as in-house architect for William Zeckendorf, a major real-estate developer, he cut his teeth designing office buildings, mixed-use complexes, and urban-renewal housing projects. Pei attracted to Zeckendorf's group a number of other architects with whom he eventually started an independent firm. The team quickly received important commissions, such as the 1964 assignment to design the John

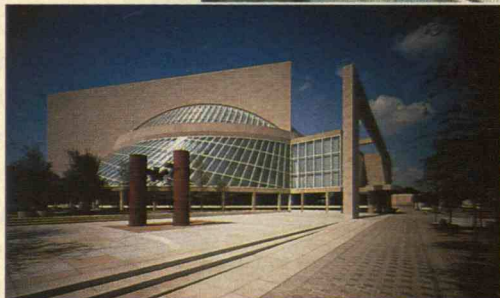


F. Kennedy Library in Boston.

Not all observers offer rave reviews of Pei's work. Jane Holtz Kay, architecture critic for the *Nation*, maintains that with structures such as the Louvre's pyramid, Pei has practiced a "'Hey, look at me' kind of architecture" with an approach that "reflects an incomprehension or indifference" regarding the surroundings. Fred Kent, president of the New York-based Project for Public Spaces/Center for Rebuilding Community, maintains that in Pei's work "humans' needs are incidental to the architecture." Wiseman hints in his book at a similar problem with some of Pei's buildings, but also observes that he finds the architect's recent buildings much more inviting.

In a fitting description of someone so keen on technology, Rob-

THE FACADE OF THE  
MORTON H. MEYERSON  
SYMPHONY CENTER IN  
DALLAS (ABOVE, LEFT) IN-  
CLUDES A CURVED WALL  
OF INDIVIDUALLY EN-  
GINEERED PIECES OF  
GLASS THAT LOOKS OUT  
TOWARD PART OF THE CITY  
(RIGHT). I.M. PEI BIOG-  
RAPHER CARTER WISEMAN  
HAS WRITTEN THAT THE  
CONCERT CHAMBER  
(ABOVE, RIGHT) HAS "THE  
SPIRIT OF THE INTIMATE  
EUROPEAN HALLS OF THE  
EIGHTEENTH CENTURY."





ertson calls Pei "a lovely, kind gentleman" who has a "titanium spine." While "he's a good listener" and considers others' ideas,

"I.M. belongs to that group of wonderful architects who believe fiercely in the conclusions they reach," Robertson says. Now 77 and only officially retired, Pei recently spoke with *Technology Review* senior editor Laura van Dam while sitting in his office, spare but for a mountain of papers on a desk in the middle of the room. Pei says he can't respond to general criticisms and vague charges; he can only assert that particular designs were appropriate to individual sites, users' needs, and the like. He readily launches into details about buildings he helped design, skipping among decades in the process.

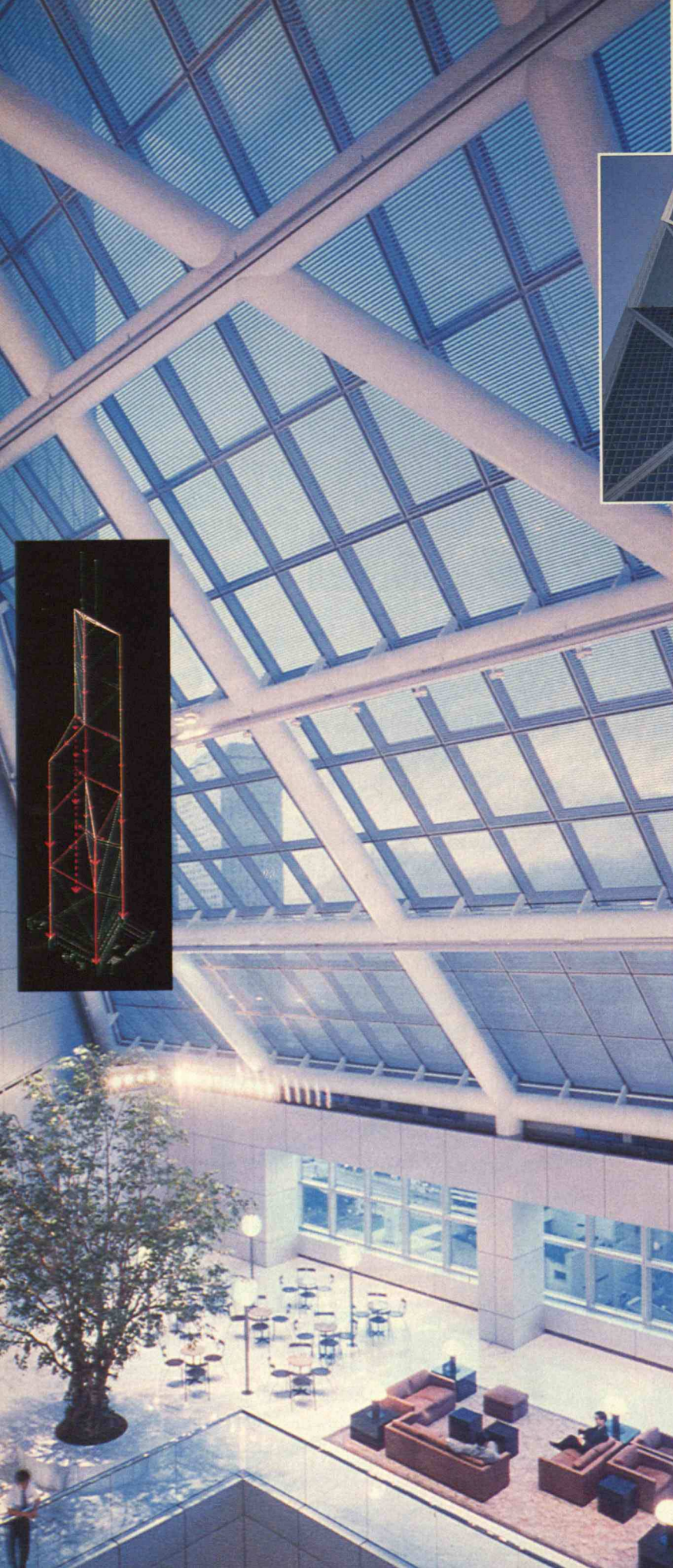
TR: When you design a building, do you start by thinking about artistic elements or by focusing on technical concerns?

PEI: Architecture is unique in that it straddles science and technology on one side and aesthetics on the other—encompassing form and space as well as the history of art. If a person is knowledgeable in only one area and ignorant in the other, he or she simply cannot create the best work. To be complete, one has to make the most out of the two realms.



INSET, LEFT: A SKETCH OF HONG KONG'S BANK OF CHINA BUILDING SHOWS HOW THE USE OF STEEL BEAMS RUNNING THROUGH-OUT THE STRUCTURE AT 45-DEGREE ANGLES SPREADS WIND LOADS TO THE BUILDING'S CORNERS. BEAMS, VISIBLE WITHIN THE STRUCTURE (LEFT), ARE TRACED BY PLATES ON THE OUTSIDE (ABOVE).

OPPOSITE PAGE: A SKETCH BY I.M. PEI AND AN ARCHITECTURAL MODEL SHOW HIS ASYMMETRIC DESIGN FOR A BRIDGE CONNECTING A MOUNTAIN-SIDE TUNNEL WITH A ROAD ON A FLAT SHORE NEAR KYOTO, JAPAN.





The degree to which one field or the other may enter into a particular design depends on the subject in question. For instance, if you were to design a simple boutique, science and technology wouldn't enter into the picture very much, except in perhaps satisfying special lighting needs. But in designing a many-storied building, you'd better take technological concerns into account right from the very beginning. While not all architects do—some postmodernists simply say that to design a tall building all you have to do is decide on a façade and put a unique “hat” on the top—structure was critical to the design of our Bank of China building in Hong Kong.

TR: How so?

PEI: I knew almost immediately after the government of China approached me in 1982 that this had to be a tall structure, because land costs are high in Hong Kong. There were also a number of fairly tall buildings next to the site, so that if the new building didn't have a certain height, it wouldn't be seen at all. Plus, this site was outside the flight path of airplanes, so we could really build high.

TR: Given that decision, how did you design the particular structure you came up with?

PEI: In part that came about because we had to build economically. China is not a rich country. The other critical factor was weather. Given Hong Kong's occasional typhoons, wind forces there can be twice as great as in New York. The challenge was to design a structure that could withstand those forces yet also save money. I recognized that the answer could lie in a design that would employ less than the usual amount of steel while being structurally sound.

I therefore thought about the triangle, which is the strongest structural form. If

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the building could essentially consist of shafts with triangular cross sections, it would automatically be very, very rigid. So I made some three-sided sticks and played with them at home, combining them in various arrangements.

Our final idea was to connect four vertical shafts—each with triangular cross sections—of varying heights by trussing them together with steel beams running right through at 45-degree angles. With this frame serving as the main structural component, the resulting building required less steel—because it needed fewer continuous, interior, “gravity” columns—than a traditional skyscraper built to endure the same wind forces.

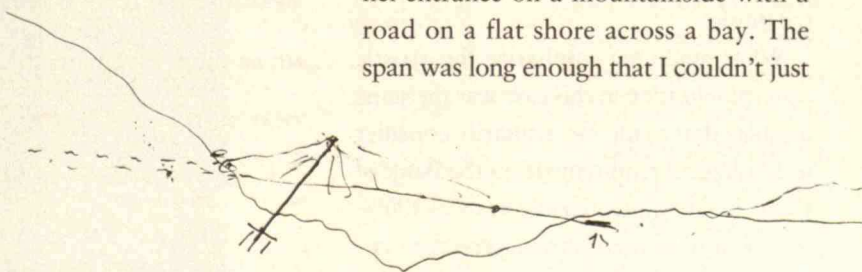
The idea of the different heights of the shafts also led to very interesting aesthetic possibilities. One could create faceted sides, just like a brilliant cut diamond. In fact, we lopped off each of the four tops at 45-degree angles. But the design didn't start as an aesthetic judgment. That thinking came later.

TR: Have structural needs been your primary concern in other designs?



PEI: Yes. I've recently designed a suspension bridge with an engineer. Although my role was to make a beautiful bridge, I had to begin with a preoccupation with structure.

In this case the bridge, which will be near Kyoto, Japan, has to connect a tunnel entrance on a mountainside with a road on a flat shore across a bay. The span was long enough that I couldn't just





put a beam across: a suspension bridge was necessary. But I decided that a traditional design, with two towers suspending the cables, would not be aesthetically correct. Such a bridge would be symmetrical, in contrast to the surroundings of mountain-side and horizontal shore. The area's asymmetry called for an asymmetrical bridge design. My idea was to hold up the bridge cabling with just one tower that angles into the mountain slope. Then the other end of the bridge can lightly rest on the shore.

**TR:** What's an example of your work in which your artistic conceptualization of a space has strongly driven the design?

**PEI:** One might be the Rock and Roll Museum in Cleveland, which is expected to open later this year. In that case, I had to start with a good sense of what the music was about. The problem was that I didn't like the music. My children loved it, but I never did. And yet, since I was selected to do the project, I had to learn about the music. So I went to Graceland to see Elvis Presley's home. I went to Louisiana to listen to jazz and rhythm and blues. And then I began to understand the rich roots of rock and roll.

These are the things I tried to imbue in the building's design—a sense of tremendous youthful energy, rebellion, flailing about. Part of the museum is a glass tent leaning on a column in the back. All the other forms—wings—burst out of that tent. Their thrusting out has to do with rebellion. This, for me, is an expression of the musical form of rock and roll. And it seems to work for my clients, who own major recording businesses and understand the music.

What made me emphasize the artistic conceptualization in this case was the same impulse that made me primarily consider technological requirements in the Bank of China building: an architect starts by thinking about what needs drive a project.

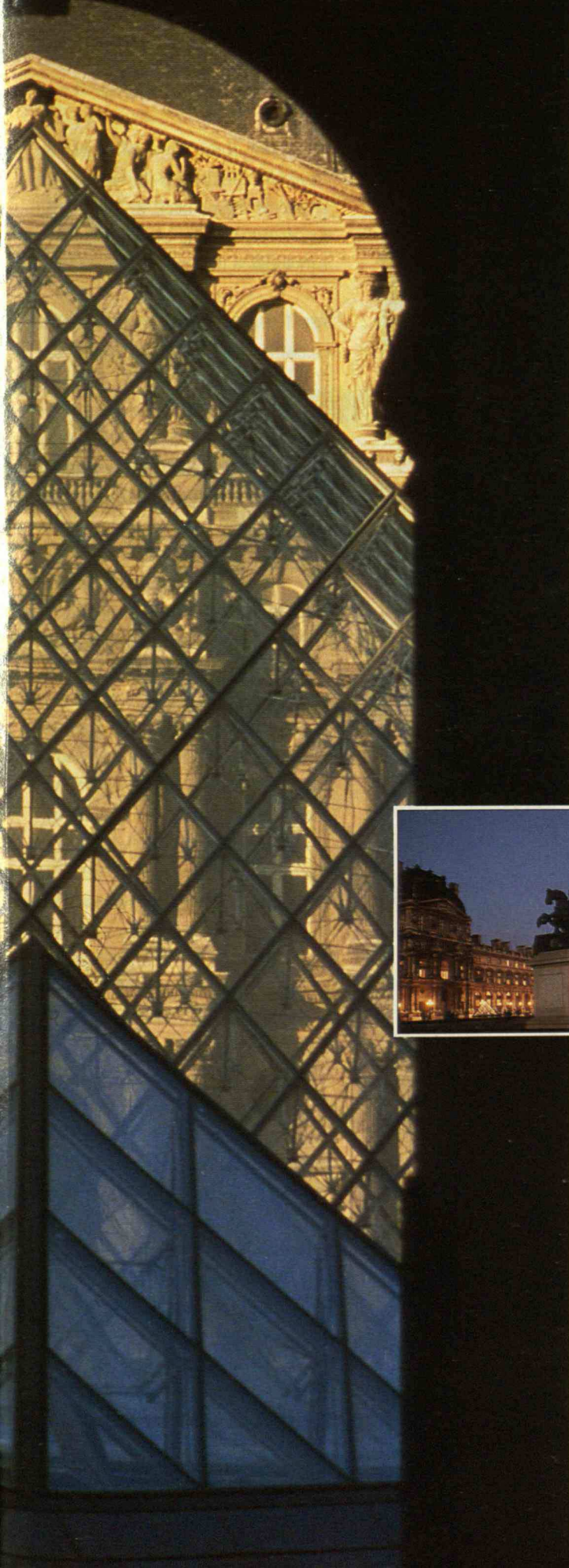
If it's a space for worship, such as a cathedral, I would have a spiritual kind of chal-



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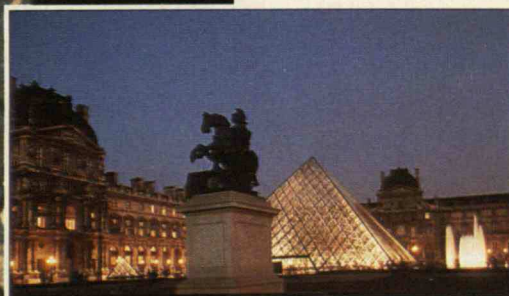


lenge. Only after figuring that out would I perhaps draw on technological means to help me achieve that sense. That's what the gothic builders faced when they created cathedrals. Given the challenge of working with just stone, they used flying buttresses to make a very tall space, which suggested reaching heaven.

TR: Speaking of old structures, you have called the Louvre "perhaps the most important urban composition in the world today," noting its 800-year history and the challenge of redoing it from its most recent uses—as museum and government offices—to serve solely as a museum. What technological challenges did you face with that project?

PEI: One of our primary problems was deciding how to light up the glass pyramid through which people enter the museum. I wanted the lighting to help symbolize the Louvre's transformation. I wanted the transparent glass so that one could see

through it to the old buildings. And I wanted a pyramid because it has facets, which begin to mirror the level of detail found along the rooftops of the old Louvre—in the form of statues, chimneys, and the like. But these requirements posed a problem: we knew from experience that if we tried to light a glass room the light would simply dissipate into the sky. So the question became, "What can you do to make the pyramid shine?" The answer was to light the very fine, stainless-steel cables that support the glass. They work like filaments in an electric bulb—that pyramid is



THE RENOVATION OF  
THE LOUVRE  
MUSEUM IN PARIS  
INCLUDED A GLASS-  
FACETED PYRAMID  
FOR A NEW EN-  
TRANCE (ABOVE  
AND LEFT) AND  
GLASS COVERINGS  
FOR COURTYARDS  
THAT ARE USED TO  
EXHIBIT SCULPTURE  
(INSET, FAR LEFT).



actually a gigantic lantern.

TR: What about the challenges you have faced in the less-known second phase of the project, in which you are rehabilitating old government office space into museum rooms?

PEI: The contractor actually had the major technological challenges—for

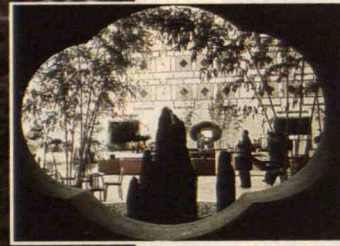
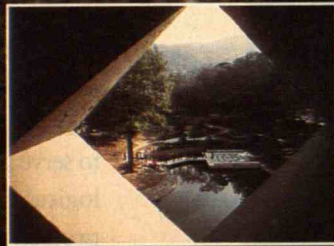
example, how to keep the façade from collapsing while the company gutted everything inside, including the floors. And since the foundations had

been built in 1850 of loosely placed stone, they had to be reinforced.

The only technological challenge the architects faced was determining how to cover the three open-air courtyards so they could be used to display sculpture indoors. They had been used for VIP parking and such until the renovation. The coverings had to span big distances, yet be as transparent as possible to retain the courtyard feeling and to avoid interfering with the 1850s architecture of the courtyard walls.

TR: What was your solution?

PEI: I collaborated with the structural engineer, Peter Rice of Ove Arup & Partners of London, to design the necessary details. The new



PEI'S FRAGRANT HILL  
HOTEL NEAR BEIJING  
IS SET IN A WOODED  
AREA AND INCLUDES  
DETAILS SUCH AS  
POOLS, ROCK GAR-  
DENS, AND LOTUS-  
SHAPED WINDOWS.



roofing consists of steel trusses with a grid of smaller members into which glass has been fitted. Rice worked with a significant constraint: none of the courtyard walls are the same. The glass had to be cut precisely to prevent moisture from leaking in.

TR: At times one's design goals could lead to a building that the public may react to very differently than the architect. For instance, some critics have said that a number of your buildings stand somewhat aloof from nearby buildings and spaces.

PEI: I welcome critics because they are bound to have good reasons for their concerns. But rather than generalizing about my work, they should look at each project by itself. The basic challenges in building design differ from project to project, and critics have to understand those—where a project is built, and why.

When I designed the 325-room Fragrant Hill Hotel outside of Beijing, for instance, I had to consider the surroundings and how people live in China. I could not simply apply my notions of American housing to that country. The sensibilities of the Chinese people are not the same as the sensibilities of Americans. So I gave that hotel a full courtyard, small and big gardens, and funny, lotus-shaped windows. My design very much fit into the context of its surroundings, and I will challenge anyone to dissuade me from that.

But take another example, one that many people criticized as not fitting into its surroundings. When my firm—credit really goes to my partner Henry Cobb, who headed the architectural work—built the John Hancock tower in Boston in

the 1970s, people asked why we designed a 62-story building in the middle of Copley Square, which some compared to an eighteenth-century drawing room. Our answer was that the square is not a very good drawing room; it is a mess. Sure, it has a few good pieces of furniture in it, such as Trinity Church, which was built in 1877, but the rest is junk. We had to say, "It's time for a change, fellas." In this case the Hancock tower re-created the square, in an appropriate way, bringing in a new form of architecture even while the mirrored façade reflects the church and other surroundings.

It's true that in recent years I have done many projects for public use, which tend to be a bit more aloof from other buildings. Yet consider the Louvre. In that case I built only the pyramid above ground, so that we would not violate a monument that is part of French culture and history. (We added 670,000 square feet of new infrastructure below ground.) And the only reason we built something like the pyramid is because it signals the heart of the museum. An enormous, singular building dancing by itself outside the Louvre would have been narcissistic, which is not my kind of architecture.

TR: Do you think architecture should have any particular higher goals these days?

PEI: That depends on the architect's vision. A socially concerned architect will go one way; an environmentally conscious architect will go another way. When I was young I was very interested in social architecture—I did a lot of low-cost



TOP: CLEVELAND'S ROCK AND ROLL MUSEUM, SHOWN UNDER CONSTRUCTION, INCLUDES FORMS PUSHING OUT IN VARIOUS DIRECTIONS, WHILE THE 62-STORY MIRRORED JOHN HANCOCK BUILDING IN BOSTON (CENTER) TOWERS ABOVE ITS NEIGHBORS. BOTTOM: PEI DESIGNED THE EAST BUILDING OF THE NATIONAL GALLERY OF ART TO INCLUDE TWO TRIANGULAR COMPONENTS THAT FIT SNUGLY ONTO A TRAPEZOIDAL PIECE OF LAND.





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housing and slum clearance in the 1950s through the first half of the '60s.

But now I find it limiting for me to design buildings for social good only. Today I'm interested in architecture as art, which can also serve humans. People enjoy art at the level of the soul. I want to affect the physical environment in a way that takes humans beyond their everyday motions such as eating, sleeping, and worrying about money.

At one level my goal is simply to give people pleasure in being in a space and

walking around it. But I also think architecture can reach a level where it influences people to want to do something more with their lives. That is the challenge that I find most interesting.

But I have to repeat that you can't satisfy an artistic challenge without taking into account the technological requirements of a project. Science and technology play as much a role in architecture as does art. The architect has to combine both disciplines. ■



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# Enlightened Conflict Resolution

*When companies tangle with regulators and public-interest groups over environmental issues, an ounce of consensus building is worth a pound of confrontation.*



A plant manager, suddenly swamped with new orders, finds that his facility cannot produce enough to meet skyrocketing demand. To capitalize on the growing market, his company draws up plans to build a new regional production facility on a parcel of company-owned land near a wildlife sanctuary.

Eager to move forward, senior managers take all possible steps to ensure that the plant will meet regulatory requirements. They file permit applications with federal, state, and local authorities and submit detailed plans showing how they intend to safely store a small quantity of hazardous byproducts. Convinced that they have acted responsibly and that their plans show that the facility is environmentally sound, the managers are confident they will be able to begin construction in time to capture growing demand.

But just when it looks like they are on the verge of winning approval, environmental activists protest that hazardous

chemicals stored on the property are sure to leak into groundwater, contaminating the sanctuary's fragile soils. A neighborhood association forms to oppose any industrial development near the preserve, insisting that local bylaws prohibit the project. Nearby property owners, who fear that chemicals stored on the premises may endanger their children, demand full-scale public-health studies.

Cries for more public hearings erupt while lawsuits are filed in federal and state court. Round-the-clock demonstrations begin in front of the company's headquarters. The company is forced to suspend its plans while it begins the acrimonious and costly process of defending itself against public attack.

This familiar plot has played out hundreds of times in recent years. Long gone are the days when industry could act unilaterally; now, whether a company wants to site a new plant, manufacture a new product, obtain a permit to dispose of wastes, secure a license, or use a

new technology, chances are it will have to negotiate with dozens of individuals and organizations.

Until recently, companies had little choice but to pursue such negotiations in highly adversarial forums. At public hearings, discussions about the plans of individual enterprises quickly degenerate into shouting matches. When suits are filed, the cases sometimes drag on for decades without solution. And, in the end, such conflicts rarely yield definitive answers. Instead, companies are typically directed to find another site, do another study, try another tack.

Fortunately, new techniques have emerged to help everyone avoid such escalating and fruitless hostility. Perhaps the most effective is a process that brings all parties together in a consensus-building dialogue.

One successful example occurred during a 1987 conflict over the aerial spraying of herbicides involving the manufacturers of forest products, environmental groups, and the Minnesota Department



of Natural Resources. The companies had long used the chemicals to control the growth of underbrush around commercially valuable pine trees. But environmental groups began to argue that the chemicals were dangerous and aerial spraying magnified the danger.

An assessment by the Department of Natural Resources affirming the safety of the herbicide did little to assuage the concerns of the environmental groups—in fact, they threatened to take legal action against the agency. With all sides preparing for a fight, tensions were running high.

The vice-president of Weyerhaeuser, a major forest-product manufacturer, suggested that the parties consider hiring a neutral facilitator to help them reach agreement out of court. By participating in a facilitated dialogue, the company hoped to ensure that its concerns would be taken into account in the design of any new restrictions on aerial spraying. Weyerhaeuser also thought it had a better chance of winning on the merits of its proposals if people would simply listen to what it had to say, and that a court suit would produce a flood of damaging publicity. Whatever qualms the other parties had about trying something new were overcome by the specter of litigation and deteriorating relationships.

### Preparing for Negotiations

The parties hired an experienced facilitator from the Mediation Institute, an organization specializing in resolving disputes over natural resources, and they selected representatives to sit at the negotiating table. In eight day-long sessions, the facilitator helped the group devise new regulations that both industry and environmentalists could support, transforming a hostile debate into a consensual agreement. The group decided to reduce over a period of eight years the number of acres that could be sprayed by aircraft, but it also included provisions to help industry make the switch to other methods of managing vegetation growth and to support the University of Minnesota's efforts to develop non-

chemical alternatives to pesticides.

The secret to negotiating effectively is understanding how the world looks from someone else's vantage point. This way of thinking runs counter to the training of many managers (and people in general). Too often companies send the toughest talker or the person who is most technically adept. But when such negotiators stick to presenting a deluge of facts, or forcefully reiterating hardened positions, they are unlikely to win many converts.

The company's negotiators must be allowed to engage in problem solving. Too often, their marching orders dictate a strict yes or no position. In fact, they often simply give a prepared speech that is designed to prevent them from improvising, and thus straying too far from positions that have been vetted in advance. When other negotiating parties reject the position outlined in the speech, the company's representative has nothing to add.

Instead, before a company sends representatives to the bargaining table, it should convey to them a complete and accurate conception of its own interests and a realistic appraisal of the costs of no agreement. This will give them room to negotiate and recognize a satisfactory outcome if one is proposed.

Companies must also be willing to share information. In adversarial forums like public hearings and court rooms, science is too often used as a tool to discredit the technical claims of opponents. In collaborative processes that rely on joint fact finding, parties agree on a method for gathering technical information and jointly evaluating it once it is before them. While they are likely to view the implications of this information differently, they can accept its relevance and accuracy.

Joint fact finding played a key role in one of the Environmental Protection Agency's first experiments with consensus building in the early 1980s. The EPA decided to use the process in determining the financial penalties that would be imposed on truck or engine manufacturers who failed to meet emissions stan-

dards set by the Clean Air Act. These penalties were intended to maintain a substantial financial disincentive for foot dragging, while also allowing companies time to phase in new manufacturing technologies.

### Sharing Proprietary Information

EPA invited key manufacturers, environmentalists, and regulatory agencies to meet and discuss the penalties. Early in the conversation, the representatives agreed that they needed a way to estimate the effects of different formulas. The group developed a computer-based spreadsheet that allowed them to model the outcomes for various segments of the industry. But building such a model required proprietary data on production costs from the truck manufacturers at the table. Not surprisingly, the companies were reluctant to share too much of this information. They were also concerned that such sharing could violate antitrust rules.

To ease their nervousness, the parties funneled the numbers directly to the neutral facilitator, who entered them into the database and removed all means of identifying the sources. The facilitator was also careful to avoid exposing any proprietary information when reporting the model's results.

This process made it possible for all parties to reach consensus on a controversial regulation. Since each group had agreed to share information at the outset, they were far more likely to trust the results, and to use them to build an agreement rather than to simply discredit each other's claims. Since this case, the EPA has adopted consensus building as a major negotiating tool and in the past decade has applied it successfully in more than a dozen efforts to design new regulations.

Of course, consensus building will not work in every case. Many advocacy groups are nervous about their capacity to negotiate effectively—especially with the high-priced lawyers or public-relations experts that sometimes represent large corporations. They would prefer to



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battle it out in court where they know what to expect. Others worry that a willingness to negotiate will be read as a sign of weakness and might therefore undercut their ability to galvanize their members (and raise money). But such groups usually agree to participate when they realize they will retain the right to say no if the results of the negotiation fail to satisfy their concerns.

Some proposed regulations are inappropriate candidates for negotiation because there is no way to find common ground. For example, efforts to decide when very small amounts of low-level nuclear waste could be treated like other kinds of waste did not lend themselves to facilitated negotiation. The environmental community wanted the amount to be set at zero, which industry could not accept. The parties' stated unwillingness to talk was not just posturing; advocates for each side preferred not to signal the arguments they would make in court. This process proceeded in the usual contentious fashion.

Despite such exceptions, experience suggests that mediated negotiation can offer an attractive option to the adversarial process. The approach is more likely to work when no group is better off without an agreement of some kind, when the parties involve a neutral facilitator before the conflict escalates or they reach an impasse, and when government officials endorse the desirability of searching for common ground.

Finally, top management in industry has to swallow hard and decide that it is prepared to sit across the table from groups that it has demonized in the past and listen sympathetically, perhaps for the first time, to their concerns. ■

LAWRENCE SUSSKIND, professor of urban and environmental planning at MIT, directs the MIT-Harvard Public Disputes Program at Harvard Law School and chairs the Consensus Building Institute in Cambridge, Mass. SARAH MCKEARNAN is a research associate in MIT's Department of Urban Studies and Planning and is deputy editor of *Consensus*, a quarterly newspaper on public-dispute resolution distributed to elected officials in North America.

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## Regulating the Regulators

**I**F the November elections did indeed signify a commitment to limited government, as the Republican victors exuberantly claim, then one matter presents engineers, as a profession, with daunting challenges. I refer to the issue of government regulation—or, more precisely, deregulation.

The impulse to do away with red tape, to rescue the free-enterprise system from its bureaucratic tormentors, has been with us for a long time. Engineers have no special insight concerning rules that govern trade, banking, and financial practices. But where technical questions are central—for example, in ensuring product reliability, environmental protection, and safety in the workplace—engineers have expertise that carries with it special responsibility.

Back in the 1830s, when steamboats started to explode with distressing frequency and appalling loss of life, the prevailing view in Congress was that the Constitution prohibited legislation restricting the “freedom” of entrepreneurs. Senator Thomas Hart Benton proclaimed that the proper way to tell if a boat was safe was for each passenger to personally check it out upon boarding. But continuing disasters and growing public outrage led to a modified view of what rights and obligations belonged properly to the federal government. Eventually, laws were passed requiring government inspection of life-threatening steam boilers.

The concept of government responsibility grew slowly. A turning point came in 1906 when, under President Theodore Roosevelt, the Pure Food and Drugs Act became law. Roosevelt also oversaw enactment of the Meat Inspection Act and child labor laws. Oscar R. Straus, Roosevelt’s secretary of commerce, had this to say about his feisty president: “A great man is he who discovers the evil tendencies of his time, and has the wisdom, the ability, and the determination to correct them.”

In the ensuing years we have learned that government regulation is vital to the progress of technological civilization. Regulation protects the public interest; it

also serves industry by providing useful standards, ensuring consumer confidence in product safety, and limiting legal liability of regulated companies. If we want technology to grow and flourish, we must expect the scope of regulation to increase.

Of course, excessive or unwieldy regulation is counterproductive, harming not only business but also society as a whole. But contrary to public perception, Congress does not generally “legislate” technical regulations. Instead, it creates statutes full of such terms as “generally recognized as safe”—words that give much discretion to regulatory agencies. Rules are typically promulgated only after public hearings. These proceedings are somewhat sheltered from shifting Washington power struggles but not totally so, nor should they be: while the measurement of risk is an empirical and scientific activity, deciding

tions, and fresh conceptual approaches. A recent study by the National Research Council’s Marine Board suggests how the several agencies responsible for the safety of underwater pipelines carrying natural gas and crude oil might coordinate their work, thus minimizing confusion and increasing effectiveness. Engineers at the Environmental Protection Agency are developing electrostatic filters that can be added on to existing emissions control systems, so that power plants and factories could meet air pollution limits at far lower cost than would be entailed in purchasing entirely new systems. The Occupational Safety and Health Administration is drafting an ergonomic protection standard that would seek to reduce the incidence of muscle and bone disorders. But unlike most OSHA standards, this one would not contain myriad requirements for things like table heights and chair



the acceptability of risk, and the equity of its distribution, is properly political.

It is crucial that engineers—whose great talent is design—seek to devise an ever-more-effective regulatory system. This should not entail total reliance on cost-benefit analysis (that favorite stratagem of small-minded conservatives) nor quixotic searches for “total” safety (a chronic demand of fainthearted liberals), but rather a judicious evaluation of the many dilemmas that technological progress presents.

There are already encouraging examples of engineering responses to the regulatory issue: improved procedural efficiency, ingenious new technical solu-

designs. Instead, it would require that companies respond constructively to worker injuries and complaints. The onus would be on business to solve the problem, not simply to follow dozens of arbitrary rules.

Applying the pragmatism and ingenuity of their craft, engineers should work to preserve useful regulations and redesign those that are defective. In this time of frenzied political transition, they can offer the voice of reason. ■

*SAMUEL C. FLORMAN, a civil engineer, is the author of Engineering and the Liberal Arts, The Existential Pleasures of Engineering, Blaming Technology, and The Civilized Engineer.*



## Averting a Race to the Bottom

**W**ITH the passage two years ago of the North American Free Trade Agreement (NAFTA) and now the latest round of the General Agreement on Tariffs and Trade, many workers and local government officials worry that industry is poised to shift operations across national borders. These fears are justified.

As Cornell University law professor Katherine Von Wetzel Stone explains in a new paper, there is precedent within the United States alone: companies have often used differences among the states to play off groups of workers and citizens against one another. In 1933, Supreme Court Justice Louis Brandeis warned of the waste when states bid for businesses by offering the least costly regulatory environments. Such competition, Brandeis said, could only lead to what he called a socially destructive "race to the bottom." As it has become more feasible to move production to low-wage, weakly regulated economies such as those in Southeast Asia and Eastern Europe, the risk of such a downward spiral has intensified.

For all the political rhetoric on "free trade," all countries, including the United States, attempt to defend their labor standards from such a mutually destructive race to the bottom. American practice has recently favored negotiating side agreements to trade deals, such as those attached to the pacts with Canada and Mexico. Unhappily, the NAFTA labor accords are toothless. The United States can insist merely that our trading partners enforce their own national labor laws—which, in Mexico's case, have permitted wages to remain very low while failing to ensure workplace health and safety or to guarantee workers the right to unionize.

Recent developments in Europe offer a promising alternative. The European Union (EU) awards economic development and skill-training grants to the continent's poorest regions. The goal is to reduce the differentials in labor standards so that companies choose locations on the basis of attributes such as proximity to markets, good infrastruc-

ture, and skilled workers rather than negative ones such as lax labor or environmental standards. In some cases, the European Parliament has also passed preemptive legislation that forces member countries to adhere to certain standards. Of course, the EU is not a true supranational government, and convincing the member states to agree to such laws can be difficult.

As a second-best strategy, the EU is working to get individual countries to reconcile their own labor laws concerning multinational business and working conditions. EU directives establish minimal standards that member countries are expected to gradually approach, following their own internal legislative processes. Such directives provide resources, institutional means, and legal penalties designed to facilitate—and, if necessary, force—companies to comply. This "harmonization" reduces the incentive of

Japan—that does business in more than one European country disclose to its European employees information on the company's sales, employment numbers, investment plans, intentions to introduce new technology, and expected closures and mass layoffs.

It is too early to measure how the directive will affect investment and location practices within Europe. But given that region's huge pool of affluent consumers and skilled workers, and its superb business infrastructure, it is not likely that companies roaming the globe for new investment opportunities would consider boycotting the place. We will know that the new directive is successful if companies come to treat it as just another fact of economic life. Ultimately, these policies should encourage businesses to make future location decisions in terms of the long-run possibilities for achieving high productivity levels instead of short-run



companies to move their factories to regions with cheaper, less well-protected labor forces.

For example, one new directive, passed in 1994 after 20 years of trying, aims to make companies less secretive about information pertaining to threats to relocate. A company will sometimes tell workers and public officials in one country that it can produce more cheaply in another country. Companies have been known to bluff, but their demands for concessions are hard to resist if the underlying production and cost numbers are kept secret. The new directive requires that any company in the world—including firms based in the United States or

efforts to slash labor standards.

Governments will continue to attempt to regulate the behavior of multinational business. Excessive regulation can of course contribute to bloated public bureaucracies, even as it hampers innovation by the private sector. But without some degree of regulation, the danger of a global race to the bottom is all too real. Finding the right balance is one of the great challenges in the years ahead. ■

*BENNETT HARRISON, a visiting professor of political economy at Harvard's Kennedy School of Government, is the author of *Lean and Mean: The Changing Landscape of Corporate Power in the Age of Flexibility* (Basic Books).*



# Reviews

BOOKS

## ECONOMIC ELIXIRS AND THEIR DISCONTENTS

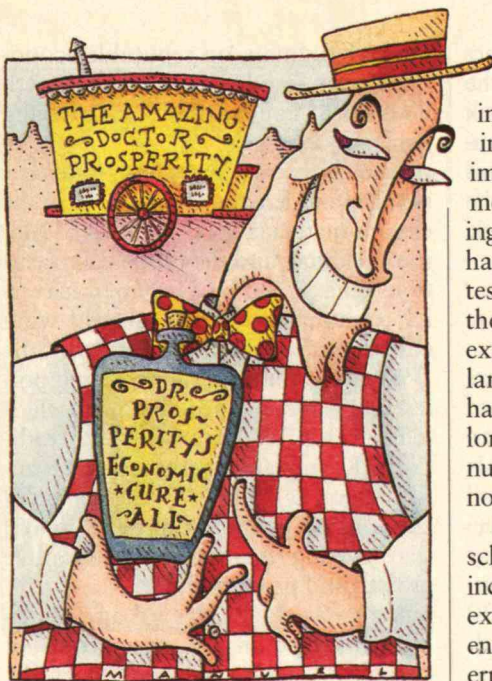
*Peddling Prosperity: Economic Sense  
and Nonsense in the Age of  
Diminished Expectations*  
by Paul Krugman  
Norton, \$22.00

BY ROBERT J. CRAWFORD

ECONOMICS occupies a peculiar place among the social sciences. By limiting itself to simple, well-defined transactions—the purchase and sale of goods and services for profit—the field has earned a reputation as a fairly “hard” science. Results can be observed and measured, and theories can presumably be tested in policies. But judging from the noisy debate on the national scene, where hordes of competing “experts” flatly contradict one another every day, the public has come to regard economics as little more than a handy tool for double-talking politicians.

In *Peddling Prosperity*, Stanford economist Paul Krugman argues that political dialogue lags years behind economic science, largely because of the rhetorical excesses of “policy entrepreneurs,” the spin masters who supply politicians with pseudo-intellectual economic arguments. In an attempt to make the political dialogue more intelligent and meaningful, Krugman has written a lucid primer on the current state of mainstream economic theory in the academy.

The story begins in the 1960s, according to Krugman, with the conservative attack on Keynes. His liberal doctrine, which ruled economic policy for over a generation after the Great Depression, followed a deceptively simple logic. When businesses and consumers lose confidence, fearing to invest or purchase goods and services, they begin to hoard money. Soon reduced consumer demand



forces businesses to lay off workers, which initiates another round of money hoarding and layoffs as the economy slides into an ever-lower state of equilibrium. Keynes's cure calls for the government to expand the money supply by spending when consumers won't—priming the pump with lower interest rates and government-financed public works.

Enter Milton Friedman, the first credible leader of the revolution in conservative economics. Taking issue with Keynes's theory, Friedman believed that the national economy grows at a “natural,” or long-run, rate that the government cannot influence. Accordingly, the key to economic well-being is to match the growth of the money supply with this natural rate. To put it another way, Friedman based his ideas on the law of supply and demand, except that for his purposes the supply of money is the determining factor. If it lags behind the long-run growth rate, the result is recession; if it expands faster, inflation occurs.

Until the late 1960s, Krugman writes, most of Friedman's fellow economists regarded his theory—known as “monetarism”—as a questionable free-market ideology. But the credibility of his “Chicago school” was enhanced when

he accurately predicted the stagflation of the 1970s. If the government injected money into the economy, the impact on employment would be minimal, he said: firms, wanting that money, would respond by simply raising their prices. And that is exactly what happened. Still, monetarism, when tested in policies, has failed to deliver the steady growth it promises. For example, in Margaret Thatcher's England, policies based on monetarism halted inflation at the cost of massive long-term unemployment and barely nudged productivity upward, Krugman notes.

Krugman scrutinizes several other schools of conservative economics, including the once-fashionable “rational expectations” theorists, who strengthened Friedman's critique of activist government. Recession, they argued, is self-correcting: to encourage consumers to spend the money they are hoarding, firms lower prices, thus initiating a round of increases in consumer demand, and eventually in employment levels. Economic slowdowns, according to this logic, are caused by confusion: firms don't realize they need to cut prices. Among the principal culprits in these unfortunate bouts of confusion are the “erratic” monetary policies of the government, which manipulate interest rates and taxes.

But as Krugman points out, recessions are often stubbornly slow to correct themselves. Could firms be “confused” for years before dropping their prices? Moreover, do firms and consumers really base their decisions on detailed assessments of tax and interest-rate policies, as members of the rational expectations school claim? And finally, if the private market really is the most efficient way to organize economic activity, why does it regularly lead to recessions and long-term unemployment?

Because monetarism and other conservative schools couldn't answer these questions, Krugman says, mainstream economists turned right back to Keynes. It was a Keynesian policy, for example, that turned around the 1987 stock mar-



ket crisis: in the face of a huge contraction in stocks prices and hence the money supply, the Federal Reserve Bank quickly pumped funds into the economy. Their confidence restored, investors and consumers no longer felt the need to hoard money, and an economic slowdown was averted.

### The Rise of the Supply-Siders

Yet even as the academic economists were rediscovering the virtues of Keynes, economic trends converged to undermine the political appeal of his theories. In the private sector, annual productivity gains dropped from 3 percent to 1, suggesting that the postwar measure of the American dream—doubling the standard of living every 20 years or so—might vanish, and accord-

ing to Krugman, no reputable economist, from Friedman to John Kenneth Galbraith, could supply a satisfying explanation.

Into the breach slid supply-side economics, an ideology far cruder than the elegant mathematical reasoning of Milton Friedman and the rational expectations school. Led by a group of maverick economists and radical right-wing editorialists like Robert Bartley of the *Wall Street Journal*, freewheeling policy entrepreneurs posed a direct challenge to Keynes, preaching that traditional Keynesian government interventions such as taxes were the principal cause of the economic slowdown and that cutting them would guarantee growth and productivity.

Krugman does not even attempt to hide his disdain for this group of “cranks,” whose lack of scientific method he finds lamentable: “Supply-siders do not fundamentally rely on empirical evidence to back their view; they believe their ideas are necessarily, logically, right, and that the academic majority is wrong.” However, he fails to consider why they got as far as they did. Nor is this failure some isolated oversight: Krugman consistently underestimates the impact of politics in his economic exegesis.

Once supply-siders gained President Reagan’s ear, they had allied themselves with America’s most influential salesman. He turned their ideology into a powerful weapon, which eventually split the New Deal coalition. The Democrats, who until the late 1970s had represented jobs to the middle class, were successfully portrayed as the cause of the 1970s slowdown, the tax-and-spend advocates of big government. The Republicans, finally able to shed their dour persona as the guardians of fiscal responsibility, broadcast an antitax message that enticed the vital center to ally itself with the wealthy.

Although Krugman correctly points out that supply-side economics did not live up to its promises—productivity gains never materialized and the economy never “grew” itself out of massive

budget deficits—the Republicans won the public’s confidence. Even worse, because the Democrats still lack a coherent and saleable economic plan, Republican Senators Newt Gingrich and Phil Gramm, both supply-siders, continue to dominate the political debate.

Unfortunately, Krugman does not fill this gap. His policy recommendations would play directly into the hands of right-wing policy entrepreneurs: to strengthen the economy, he calls for raising taxes, containing health care costs, and implementing more social programs for the poor. Moreover, he dismisses popular left-leaning economists like MIT professor Lester Thurow as facile, when in fact their views on “producer economic” states, most significantly Japan and Germany, deserve closer examination. Such pundits note that these governments actively pursue protectionist industrial policies in sectors promising high rates of growth. The successful electronics and automobile industries that have resulted may signal the birth of a new “strategic” model for national economies.

Yet despite this political naivete, *Peddling Prosperity* is valuable and delightful. Krugman displays a refreshing cynicism toward the pretensions of his own profession. He writes, for instance, that “in the academic world the theories that are most likely to attract a devoted following are those that best allow a clever but not very original young man to demonstrate his cleverness.” And he cheerfully admits when something is unknown, such as the reason productivity growth has slowed during the last 20 years. Although critics have dismissed this book as a long exercise in sour grapes—Krugman apparently failed to get a plum job in the Clinton administration—every page is challenging and informative. Krugman doggedly sticks to his version of the truth, even if it costs him influence in Washington, D.C. ■

ROBERT J. CRAWFORD is assistant director of the Office for Sponsored Research at Harvard.

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## BOOKS

## INVADERS FROM THE RAINFOREST

*The Hot Zone*  
by Richard Preston  
Random House, \$23.00

BY JONATHAN B. TUCKER

**I**NFECTIONOUS diseases, which antibiotics and vaccines once promised to banish from our shores, have returned with a vengeance. Long-forgotten scourges such as tuberculosis and malaria are staging a comeback in pernicious, antibiotic-resistant forms, and newly identified viral diseases such as AIDS have become major public-health problems.

One source of such "emerging" infections has been the encroachment of civilization on remote tropical rainforest ecosystems, allowing previously unknown viruses that have lived for eons in animal or insect hosts to infect humans for the first time. Moreover, global transportation networks make it possible for an individual carrying a contagious virus to travel anywhere in the world within 24 hours, accelerating the transmission of disease. The international spread of AIDS has followed this pattern, as have other recent outbreaks. Last October, for example, an epidemic of bubonic plague in India led many countries to cancel flights from the affected region.

*The Hot Zone*, a best-selling work of nonfiction by Richard Preston, focuses on a family of exotic pathogens known as filoviruses—Latin for "thread viruses"—because of their distinctive spaghetti-like appearance under the electron microscope. These viruses, which are generally lethal, highly contagious, and lack a protective vaccine or cure, were first identified in 1967, when African green monkeys from the Ugandan jungle were shipped to the town of



Marburg, Germany, for use in developing vaccines. The monkeys arrived infected with a previously unknown hemorrhagic virus; 31 laboratory workers who came in contact with contaminated monkey blood subsequently fell ill, and seven of them died. Preston describes in lurid detail the horrific symptoms of Marburg virus infection, which include massive internal hemorrhaging and bleeding from every body orifice.

Since that initial outbreak of Marburg virus, scattered human cases have occurred in central, eastern, and southern Africa. In 1976, a filovirus closely related to Marburg caused epidemics in Sudan and Zaire that claimed nearly 200 lives. The new virus, named Ebola after a river that passes through the epidemic region, proved to be even more virulent than Marburg, killing 9 of every 10 people infected. As Preston notes sardonically, "Ebola does in ten days what it takes AIDS ten years to accomplish."

### Death in the Monkey House

This macabre prologue builds suspense for the heart of the book, which tells the story of a little-known viral outbreak near Washington, D.C., in the fall of 1989. A company called Hazleton Re-

search Products imported some 500 wild crab-eating monkeys from the Philippine jungle to a holding facility in the Washington suburb of Reston, Va., for distribution to research laboratories around the country. Shortly after the monkeys arrived, many of them fell sick and died.

Company officials first suspected simian hemorrhagic fever, which is fatal in monkeys but not in humans. But when experts from the nearby U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) at Fort Detrick, Md., examined blood samples from the sick monkeys under the electron microscope, they were horrified to see virus particles indistinguishable from those of the Ebola type. What made the discovery even more frightening was that although the sick monkeys had been held in one room of the Reston facility, monkeys throughout the building were beginning to die. The implication was that the previously blood-borne virus had mutated into a form that could be transmitted through the air. The monkey house had to be treated as a "hot zone"—Army lingo for a place contaminated with a lethal and incurable virus.

If the virus that was killing the Reston monkeys was indeed Ebola, it posed a grave threat to the several million inhabitants of metropolitan Washington. Experts from USAMRIID and the Centers for Disease Control (CDC) in Atlanta moved in to contain the outbreak. Army troops garbed in biohazard space suits sealed off the Reston facility, killed the 500 monkeys inside with anesthetic, and sterilized the building with a mixture of steam and formaldehyde. This grisly operation, which lasted 18 days, was carried out in secret so as not to sow panic among nearby residents.

The outcome was anticlimactic: although four monkey handlers later developed antibodies to the virus, indicating that they had been infected, none came down with clinical symptoms of disease. By an inexplicable stroke of luck, the Reston virus turned out to be a new strain of Ebola that was not dangerous to humans. But Preston argues persuasively that because viruses mutate rapidly, the



next outbreak of an emerging virus could seriously threaten public health.

The strength of *The Hot Zone* is that it conveys a fair amount of technical information in the guise of a compelling, real-life horror story with engaging protagonists—a husband-and-wife team of Army veterinarians whose death-defying work belies their bland suburban lifestyle. Preston expertly describes the inner workings of USAMRIID's high-containment laboratory, which is equipped with air locks, biohazard space suits, ultraviolet lamps, and decontamination showers. He also provides an enlightening behind-the-scenes look at the bureaucratic turf battles between Army and CDC officials over which agency should take the lead in containment operations.

Yet in seeking to heighten suspense, Preston lapses at times into hyperbole and overripe prose. He writes, for example, that the Ebola virus "seemed to emerge out of the stillness of an implacable force brooding on an inscrutable intention." Equally irritating are a series of ominous events that turn out to be red herrings. The book ends weakly with a protracted and rather tedious digression in which Preston travels to Kenya, dons a biohazard space suit to explore Kitum Cave—the suspected source of Marburg virus—but discovers nothing of interest. And Preston's conclusion that emerging infections represent Nature's "revenge" for humankind's exploitation of the biosphere seems more polemical than scientific.

*The Hot Zone* also fails to suggest practical solutions to the problem it illustrates in such vivid, cinematic style. A better source of policy ideas is *Emerging Infections*, a 1992 report by the Institute of Medicine of the National Academy of Sciences. Among other options, this report recommends government subsidies for vaccine development because of the lack of financial incentives in the private sector. The report also proposes setting up a global network of epidemiological field stations to detect and characterize outbreaks of infectious disease in time to control their spread.

### Pathogens as Weapons

Ironically, for all his warnings, Preston seems not to have grasped the full extent of the danger the international community faces. He does not even mention the repugnant possibility that states or terrorists might use deadly pathogens as weapons. Given that the book's main characters work for Fort Detrick, which is responsible for developing medical defenses against biological warfare (BW) agents, his failure to discuss this possibility is puzzling.

Indeed, the use of disease as an instrument of war has considerable precedent, as indicated by the following brief historical survey.

Some medical historians believe that the Black Death—the devastating epidemic of bubonic plague that killed at least a quarter of Europe's population between 1346 and 1350—was spawned by a primitive form of biological warfare. In 1346, Tartar forces besieging a Genoese fort in the Crimean town of Caffa catapulted some of their own plague victims over the ramparts. Many of the Genoese defenders then became infected with the disease and fled back to Italy, from whence the epidemic spread rapidly across Europe.

In 1767, during the French and Indian War in North America, the English general Sir Jeffrey Amherst covertly supplied blankets contaminated with smallpox virus to the Indian tribe allied with the French; the resulting epidemic decimated the Indians and contributed to the British victory that won control of Canada.

During World War II, the Japanese Army ran a top-secret BW facility in occupied Manchuria at which some 3,000 workers grew pathogenic bacteria in giant vats. In 1940, Japanese aircraft dropped ceramic bombs containing plague-infested fleas on Chinese cities, triggering an epidemic of bubonic plague.

Beginning in 1943, the United States developed and stockpiled biological weapons, including a variety of lethal and incapacitating bacterial, viral, and toxin agents. In 1969, President Nixon ordered the program halted and all existing stockpiles destroyed.

The Soviet Union also possessed a massive BW program that appears to have continued long after the U.S. effort ended. An epidemic of human anthrax in the Russian town of Sverdlovsk in April 1979 was linked to an accident at a nearby Soviet BW facility.

Prior to the 1991 Persian Gulf War, Iraq was assessed to have developed and stockpiled militarily significant quantities of BW agents, including anthrax and botulinum toxin.

Today, about a dozen countries are believed to possess or to be pursuing biological weapons, and deadly emerging viruses such as Marburg and Ebola are on the list of potential BW threat agents. Although biological warfare may seem unthinkable, the lessons of history suggest that we ignore it at our peril.

Diplomatic efforts to halt and reverse the proliferation of biological weapons have been under way for decades. The Biological and Toxin Weapons Convention (BWC) of 1972 bans the development, production, stockpiling, and use of disease agents and toxins as instruments of warfare or terror. Although the BWC has been ratified to date by 135 countries, the treaty's complete lack of verification measures has undermined its credibility. Later this year, international negotiators will meet in Geneva to begin drafting a legally binding protocol to strengthen the BWC, possibly by requiring the declaration and on-site inspection of pharmaceutical and fermentation plants that could be misused for the illicit production of BW agents.

In sum, steps to foster international cooperation in the fight against emerging infections are vital, not only for their direct public-health benefits but also for their ability to reinforce the international norm against biological warfare. Only through aggressive vigilance on all fronts can humanity hope to hold the line against the resurgent threat of infectious disease. ■

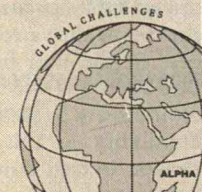
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# Phenomena

By HERB BRODY

**I**N a typical year, only four inches of rain moisten the neon-lit streets of Las Vegas. The first two weeks of 1995 brought more than half that amount—a steady drizzle that forced the 100,000 (give or take) people who came to Vegas for the Winter Consumer Electronics Show to pop up oversized umbrellas as they scurried between convention halls, clutching plastic bags stuffed with glossy flyers hyping the latest crop of televisions, radios, video games, hi-fis, and multimedia home computer systems. The surreal weather reflected the weirdness going on inside the huge and multiple exhibit halls—a one-million-plus square foot, orgiastic display of the products that more and more constitute the heart of popular culture.

**DISENGAGEMENT** • Much of what was on display were products that help people wall themselves off from the world. The world of consumer electronics shares much of the same basic technology as the world of computer networks, but the similarity ends there. The Internet has become, more than anything else, a giant social mixer; people who've never met face-to-face fall into intense e-mail relationships. Trends in consumer electronics are going the other way—toward disengagement. TV makers, for instance, are out to capitalize on the market for “home theater” systems. Exhibits by companies like Toshiba and RCA featured ersatz living rooms where weary show-goers plopped themselves down on overstuffed couches in front of monstrously large screens. Loudspeakers to the front, sides, and rear enveloped viewers in an aural cocoon. This setup naturally forces people into silence: who can compete with the booming, surround-sound

audio? Who wants to? In another trend that fosters isolation, several companies showed variants of 3-dimensional television that draw the viewer ever deeper into the screen. To use products by 3DX and Virtual I-O, the viewer has to don special glasses with colored or polarized lenses. Sanyo's

3-D system, which uses a liquid-crystal display, works without special eyewear, but the 3D effect appears at a limited range of viewing angles. Either way, the viewer becomes more securely attached to the screen than ever before—look away from it and the magic evaporates.

**VIDEO GAMES REACH NEW DEPTHS** • The video-game industry seems headed in the same direction. Nintendo is showcasing a new game system designed to maximize the player's immersion in the cyberworld. It's called Virtual Boy, and to play it you have to peer through a viewer similar to those tabletop vision testers used by some motor vehicle registries. Unlike TV-based video games, Virtual Boy puts the action in 3 dimensions: you can control movement not just left to right and up and down but also in and out. The display provides crisp, high-resolution graphics—but it's all in an other-worldly, neon-like red. The real world disappears as you tunnel alone into the game's artificial one. Even conventional video games are hardly paragons of sociability, but at least there's a screen that all can see. At my house, for instance, small gangs of 10-year-



NO  
HONEYMOON  
IN VEGAS

olds commonly engage in heated conversations around the Nintendo system; onlookers offer advice and empathetic chatter to the kid with the controls.

**MULTIMEDIA MISSES** • If video games are candy, computers are spinach—at least that's a common

parental mindset. And last year, 8–10 million computers were sold in the United States for home use, according to the market research firm Dataquest. You'd think that by now the software industry would have devised some creative and useful applications for home computers. But vendors at the show were mostly hawking a dreary assortment of educational software that served up the same old drill and practice—albeit gussied up with snazzier graphics and sound effects. Some new multimedia software is more exciting: a program that presents the British evacuation at Dunkirk during World War II, for instance, skillfully combines written text with maps, photographs, and radio broadcasts to explain this near debacle. Actually, such an audiovisual software extravaganza might do wonders in schools, where it could supplement conventional instruction. Unfortunately, while consumers are snapping up multimedia computers, most schools are still limping along with prehistoric computers that wouldn't know a CD-ROM from an LP.

**USER-SMARMINESS** • Over at the Microsoft display, hapless sales representatives tried to put the best possible face on

“Bob”—the software giant's latest idea of how to make computers fun and easy to use. As the company that introduced DOS and then Windows—neither a roaring success in the user-friendliness department—Microsoft would seem to lack a certain credibility in this new endeavor. In fact, Bob is Microsoft's attempt to shield computer users from Windows, which is in turn Microsoft's way to shield users from DOS. Bob is like a parody of user-friendliness. You want graphical icons? Well, here! The main screen depicts a room in a house, cluttered with brightly colored, kindergarten-simple representations of computing tasks—an address book, a calendar, a checkbook, a notepad, a telephone. Bob's screen has the busyness and frivolity of the Sunday funnies page. Users choose a “personal guide” from among 10 cartoon characters, including a dog, a cat, and a dinosaur. Instead of the usual choice between “OK” and “cancel,” these characters offer variations like “Sure” and “Nah.” It makes for an entertaining demo, but after a few minutes the cuteness becomes cloying. Microsoft chairman Bill Gates insisted defensively at a press conference that Bob (the name was coined by the company's ad agency) is not mere “training wheels” that users would cast off as soon as they are competent to pedal upright. Gates calls Bob a “social interface” because the little furry on-screen guides interact with the computer user. Maybe it's a zero-sum game: as new TVs and video games undermine human sociability, happy little computer programs will fill the void. It'll be a rainy day in the desert before that happens.



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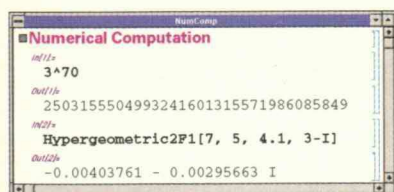
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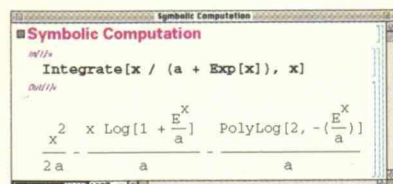
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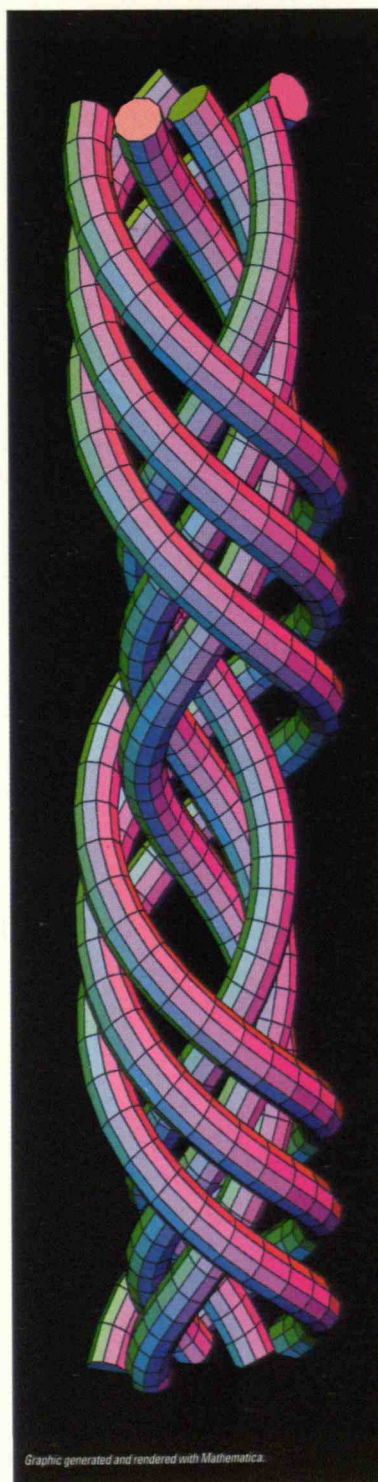


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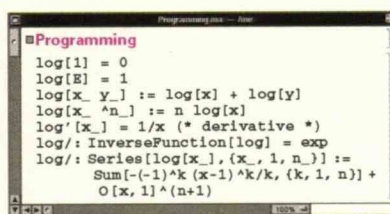
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